REPORT.107

PILOT WATERSHED STUDY SOIL AND WATER ENVIRONMENTAL ENHANCEMENT PROGRAM

REPORT #7: WATERSHED MODELLING

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EXECUTIVE SUMMARY

Objectives

The objectives of the modelling component of the Pilot Watershed Study (PWS) were as follows:

- develop spatially descriptive erosion and runoff models of the study sub-watersheds;
- apply the site specific models to the evaluation of future soil and environmental benefits relating to various agricultural land management practices; and
- use the models as tools to aid in the assessment of the erosion and phosphorus runoff processes and the effects of land management upon the runoff processes.

Watershed Models

Two different watershed models were used in the PWS. The Guelph model for evaluating efforts of Agricultural Management systems on Erosion and Sedimentation (GAMES) with the Phosphorus component (GAMESP) was set up and calibrated for the purpose of acting as a planning and communication aid. In fact, a modified version of GAMES was taken to farm level planning meetings to assist in illustrating to farm managers the long term benefit of various localized and field level changes to farming practice. GAMES also was used to highlight problematic areas in the sub-watersheds, that is, where erosion prone factors combined to increase the potential for high erosion. Further, GAMES was applied to estimating losses from hypothetical land management systems across entire sub-watersheds. These predictions represent potential long term benefit, in terms of soil conservation and improved runoff water quality, in the long term.

A second more complex model was set up and applied to a different set of tasks. The Hydrological Simulation Program-Fortran (HSPF) is a dynamic predictive model with runoff and erosion prediction capabilities as well as instream flow and material transport and transformation capabilities. This model predicts and accounts for the complete hydrological cycle and various storage compartments within the watershed (i.e., groundwater, instream, interception etc.). This model was applied to aiding in the assessment of watershed processes which affect runoff and erosion. In effect, this model was used to provide estimates of rates and fluxes within the sub-watersheds for processes which can be easily measured as well as for those that cannot. HSPF was rigorously calibrated using the continuous runoff and loading information documented in Reports #5, Hydrology and #6, Water Quality.

Both models have excellent documentation (Cook *et al* 1985, Johanson, 1980). Some of the more relevant components of the models are described in more detail along with model input requirements, data sources and the set up process.

Model Set up

In terms of set up, both models require that land areas and their characteristics be represented as model input. Both models use a system of irregular polygons with homogenous attributes. That is, each polygon has one characteristic associated with soil type, land use and slope and differs from its neighbouring polygons in at least one of the attributes. Polygons were determined using a SPANS Geographical Information System and digital information on sub-watershed soils, land use and slopes. Other model input information was determined from PWS surveys and monitoring programs.

Model Testing

HSPF was calibrated using PWS sub-watershed outflow and loading estimates for 1989. Verification was achieved by comparing predicted and observed results through 1990.

GAMESP was calibrated using 1989 to 1991 PWS soil and phosphorus losses at the sub-watershed mouths.

HSPF was shown to be capable of accurately predicting outflow rates, soil loss and total phosphorus loss on a sub-watershed scale over monthly and annual periods. Daily total flows and loads were generally reliable although snowmelt periods were not modelled accurately in the time frame of days. The model was able to respond to very short term changes in moisture conditions in the sub-watersheds which could result in increases in runoff of several orders of magnitude. The small headwater PWS study areas are very responsive to rainfall or snowmelt events. In general, annual flows and loads were predicted to within ±5% of the observed flows and loads while daily predicted values were accurate to within ±50%.

GAMESP is calibrated by adjusting two parameters which affect soil delivery until correspondence is achieved at the sub-watershed mouth. A similar process is followed for phosphorus. Actual erosion is determined using a derivation of the Universal Soil Loss Equation and is based upon long term conditions for rainfall. Soil delivery to open watershed channels is based upon overland flow path hydraulic parameters which relate to the transport capacity of overland flow.

Model Applications

HSPF and GAMESP inputs were adjusted to reflect two extreme land management schemes. A continuous fallow system was chosen to represent the worst case wherein no soil cover protection is provided throughout the year. A no till case was used to reflect a best case in which all tilled fields would be managed for high crop residue levels.

GAMESP predicted that fallow conditions would result in up to ten times more soil delivery to the Essex sub-watershed mouths depending upon the simulation year rainfall, over the existing conditions (1989 to 1991 were used).

No till conditions were predicted to result in a reduction in soil loss of up to 85%, with the highest value in the wettest year.

A similar range of relative increases and decreases were predicted for Kettle Creek and Pittock.

GAMESP predicts the changes in soil delivery are primarily due to increased crop cover and reduced overland delivery.

HSPF predictions were somewhat less optimistic. HSPF predicted affects of land management upon runoff and water balance as well as soil and phosphorus losses. Land management practice adjustments had an overall affect on runoff due to modified land surface conditions. These changes in runoff over a two-year period ranged up to 19%. Soil loss increases due to fallow conditions were predicted to range up to 87% or about double from the existing while no till was predicted to save 60% of the soil at best. Phosphorus losses under fallow and no till were predicted to be slightly reduced from the soil loss figures since phosphorus pathways include subsurface and other soluble and non adsorbed forms. HSPF predicts that phosphorus transport is not as controllable as soil loss.

Conclusions and Recommendations

The following conclusions have been presented from the modelling activities undertaken during the PWS:

- GAMESP is an effective screening level soil and phosphorus management tool. It lends itself to interactive planning at the farm field level up to the small watershed scale. The model is easy to apply and interpret using readily available information.

- HSPF is suited to assessment as it clearly links cause and effect at the primary process level. Provided with detailed input regarding watershed characteristics, management practices and watershed runoff, the model can assist researchers and planners to identify the effects of conservation tillage in the short and long term through runoff and erosion process alteration. HSPF provides real time estimates of runoff as well as erosion and can simulate subsurface as well as surface transport processes for phosphorus. In this regard, HSPF is more complete than GAMES and can be used to more fully assess and plan farm management at field and watershed scales.

- Both models predict that significant benefit can be realized through the implementation of farm conservation management systems. The GAMES predictions are somewhat optimistic and do not account for the complex interaction of processes governing runoff. The HSPF predictions indicate that factors of two to five may be relevant between worst case and best case erosion and phosphorus delivery rates. These benefits are significant in light of water quality targets for the Great Lakes and on-farm conservation expectations.

The following recommendations have been made:

- Screening level models such as GAMESP should be an integral part of the farm level planning process to achieve full implementation of conservation farming.

- Detailed deterministic models such as HSPF should be used to improve the estimation of conservation system benefits in the short and long term and as an aid to researchers in accounting for the complex system of processes governing runoff and erosion.

- More research is required to define the cause and effect relationships involved in erosion and runoff from farm fields. The currently available models are only as accurate in predicting benefit as the accuracy of input parameter adjustments. At present, several processes are poorly quantified in this regard.

- Pilot watershed studies must be continued over longer periods of time to allow for effective adoption followed by acclimatization. The PWS had achieved a reasonable level of adoption after five years. However the program did not allow for a new equilibrium to be achieved with respect to soil structure and quality, farmer practices, and crop performance.

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1.0 INTRODUCTION

1.1 Background

The Soil and Water Environmental Enhancement Program (SWEEP) was initiated in 1986 with an overall mandate to:

- reduce Ontario's Non-Point Source (NPS) loadings of phosphorus to Lake Erie from agricultural sources by 200 tonnes; and
- maintain or improve the productivity of the primary agricultural sector in Southwestern Ontario by reducing or correcting soil erosion and degradation.

The Pilot Watershed Study (PWS) is a major SWEEP sub-program aimed at evaluating and demonstrating the benefits of established conservation farming systems at the watershed and smaller scales. Figure 1.1 shows the overall SWEEP organizational structure and the PWS sub-program relationship to the Program. Cooperating agencies; Environment Canada (EC), Agriculture Canada (AC), and the Ontario Ministry of the Environment (MOE) are identified. Beak Consultants Limited (BEAK) is the prime contractor responsible to AC and MOE. Ecologistics Limited (ECOLOGISTICS) is a sub-contractor to BEAK responsible for site selection and the agronomic program of the PWS.

The PWS started in 1987 with detailed study design, staffing, training, cooperator enlistment, and watershed selection. Farm plans were initiated in August, 1988 and environmental monitoring began later the same year.

Monitoring and evaluation were conducted from late 1988 until mid 1992.

Figure 1.2 shows the location of PWS subject areas within the Lake Erie Watershed. These are situated within different yet common agricultural and physical settings.

The PWS has the following key features:

- four year implementation and monitoring period;
- **test** (conservation oriented systems) and **control** (conventional systems) paired watershed design;
- pro-active agronomic management involving annual farm planning, cooperator compensation program, ongoing producer extension program, availability of conservation-type farm implements, detailed cooperator record keeping, crop scouting and productivity analysis, and farm level socio-economic evaluation;
- intensive and continuous environmental monitoring at plot, field and watershed scales;
- detailed soil survey and soil quality monitoring;
- extensive environmental monitoring program including meteorology, hydrology and water quality; and
- detailed evaluation involving the application of two modelling systems for farm planning and systems evaluation.

The paired watershed study design is a unique approach which relies upon direct comparisons between the **test** and **control** areas as the primary method of environmental and agronomic evaluation. The effects of scale, at whole watershed, farm, field and plot scales are also a fundamental aspect of the study design which systematically addresses the relationship between producer attitudes and adoption as well as between measurable benefits, complexity, and scale.

1.2 Objectives of the Pilot Watershed Study

Objective Regarding Study/Approach

To achieve a high level of adoption of the most appropriate soil and water conservation practices among farm operators utilizing lands in the **test** sub-watersheds.

Strategy

1. Develop and employ a watershed selection process which:

    a) optimizes the probability of farm operator adoption of desirable practices, and
    b) can be applied effectively to critical areas in the larger Lake Erie basin.

2. Develop and utilize improved soil and water conservation planning tools for application at the farm and watershed levels.

3. Develop and utilize contract arrangements with cooperating farm operators which specify and compensate for participation in the project without "buying" their participation.

Objective Regarding Effectiveness

To determine the nature and degree of changes in relevant soil and water quality parameters and crop yields as influenced by "basin-wide" soil and water conservation practices.

Strategy

1. Select pairs of watersheds which are as similar as possible in respect to physiography, hydrology, and farming systems.

2. Develop and apply mechanisms to encourage adoption of soil and water conservation practices throughout the life of the project in the **test** sub-watersheds and to discourage adoption in the **control** sub-watersheds.

3. Establish soil, water and crop yield baseline conditions and monitor changes in relevant parameters throughout the life of the sub-program.

4. Correlate changes in soil, water and crop yield parameters to soil and water conservation practices and systems.

5. Evaluate improvements to planning tools (models) achieved during the sub-program.

6. Evaluate factors that affect the adoption of soil and water conservation practices and that influence farmer attitudes towards both the practices and the goals of the sub-program.

Objective Regarding Information Dissemination

To prepare information about sub-program activities and results and to transmit this to participating farmers and other related SWEEP sub-programs.

Strategy

1. Collect and transmit, as required, to the SWEEP sub-program contractor responsible for the farm-level and basin-wide economic analysis.

2. Prepare information on activities and results for the communications sub-program contractor.

3. Prepare periodic reports to cooperating farmers on activities and results in written and meeting formats.

1.3 Report Structure

The overall PWS reporting has been sub-divided into the following categories:

- Report #1 - Study Area Selection, Description and Climate;

- Report #2 - Implementation of Conservation Systems;
- Report #3 - Evaluation of Conservation Systems, Social Factors;
- Report #4 - Evaluation of Conservation Systems, Soils and Crops;
- Report #5 - Evaluation of Conservation Systems, Hydrology;
- Report #6 - Evaluation of Conservation Systems, Water Quality;
- Report #7 - Modelling; and
- Report #8 - Executive Summary.

Each report is a stand alone document including a summary, descriptions of objectives, methodologies, observations, discussion, and summarized listings of relevant data where applicable. The Executive Summary is a compilation of summaries from all of the technical reports.

This report documents the modelling activities undertaken as part of the PWS.

1.4 Specific Objectives

Models of watershed erosion and runoff have been used for three purposes in the Pilot Watershed Study, namely; as planning and communication aids at the individual farm level, as aids to system analysis, and as long term land and water quality management tools. The former purpose mentioned above is documented and discussed in Report #2, Implementation of Conservation Systems, as it was a key component of the Farm Planning aspects of the study. The latter two purposes are discussed in this report. Specifically, the objectives of this component of the study are as follows:

- develop spatially descriptive models for the six study sub-watersheds;
- develop parameter inputs for application of a screening level land management tools (GAMESP) and for a dynamic process land and water quality model (HSPF);

- apply both screening and detailed models to comparing sub-watershed pairs in terms of inherent erosion potential and erosion-runoff behaviour during the transition to conservation farming in the test sub-watersheds; and
- apply both models to evaluate long term soil and water quality consequences from various land management schemes.

2.0 WATERSHED MODELS

2.1 Introduction

This section describes the two land management models used in the PWS, namely;

- Hydrological Simulation Program - Fortran (HSPF); and
- Guelph model for evaluating effects of Agricultural Management systems on Erosion and Sedimentation (GAMES) with the Phosphorus component (GAMESP).

This description focuses upon the design capabilities of these models and the conceptualization schemes used to simulate watershed processes. In addition, the methodology which has been developed to allow for the use of Geographical Information Systems (GIS) in preparing model input and displaying model output is outlined. Finally, the simulation versions of the six sub-watershed are described.

For information on sub-watershed characteristics, a complete description is provided in Report #1, Study Area Selection; Description and Climate.

2.2 About the Models

2.2.1 The Hydrological Simulation Program - Fortran (HSPF)

2.2.1.1 Background

Land management models have been the subject of considerable development and testing during the past 20 years. Initially, hydrologic models were developed as event-based predictors of hydrologic processes and their application was limited by computer processing speeds. The Stanford Watershed Model (Crawford and Linsley, 1966) was used as a basis upon which Negev (1967) superimposed sheet and gully erosion equations as well as instream sediment transport. A lumped parameter model, PTR (pesticide transport and runoff), was later developed by Crawford and Donigian (1973). This model **piggybacked** applied pesticide onto the hydrologic and sediment transport components of the evolving Stanford Watershed Model. This approach emphasized the need for transport mechanisms of watershed hydrology as a basis for agri-chemical behaviour simulation. The PTR model included hydrologic simulation, sediment detachment and erosion, pesticide adsorption/desorption, vertical movement of pesticide in the soil, and pesticide degradation.

Further modification and testing of the PTR model resulted in the agricultural runoff management (ARM) model (Donigian and Crawford, 1976b; Donigian *et al.*, 1977). This model simulates runoff including snow accumulation and melting, sediment loss, pesticides-soil interactions, and soil nutrient transformations. Further developments to ARM added components of soil moisture and temperature, pesticide degradation, nutrient transformations, and plant nutrient uptake. The ARM model was fully supported by a user's manual and was the first practical and widely operational predecessor of HSPF.

A simpler version of ARM was developed which could be used with current urban models such as SWMM, (storm water management model) (Metcalf and Eddy *et al.*, 1971) and STORM (storage, treatment, overflow, runoff model, U.S. Army Corp. of Engineers, 1975; Huber *et al.*, 1975). The resulting model, NPS (non-point source) Model (Donigian and Crawford, 1976a and b) was a continuous simulation model which improved the snow handling and sediment transport components of urban runoff models.

HSPF (Johnson *et al.*, 1980) is the most recent and comprehensive model in this series. This model incorporates time series data management systems, recognizing the enormous task of input and simulation data handling. Channel routing is linked to land surface runoff modules and a simple sediment routing algorithm has been added. Water quality algorithms added include BOD/DO dynamics, carbon, nitrogen and phosphorus cycles, and suspended and attached phytoplankton and zooplankton. The most recent version of HSPF, release 8.0 (Johnson *et al.*, 1984) has included a chemical migration and risk assessment methodology

(Onishi *et al.*, 1979). This methodology includes sediment transport by particle size groups, pesticide routing and degradation kinetics, sediment-pesticide interaction, a frequency analysis summary of contaminant concentration, and toxicant risk assessment.

2.2.1.2 Capabilities

HSPF is a dynamic watershed hydrologic and water quality model which requires dynamic time series inputs of weather and management practices as well as descriptive characteristics of the watersheds soils, topography, drainage and land management activities. Land area discretization can be facilitated using Geographical Information Systems (GIS) and remotely sensed data. The model simulates the processes which result from precipitation on the watershed in terms of runoff and associated water quality parameter movement and behaviour. The surface runoff and sub-surface seepage is then routed to the watershed streams where it is subject to instream transport and transformation processes.

The model is built upon a systematic framework in which a series of application modules are used to perform various hydrologic and water quality processes; and utility modules are used to perform various data management functions. Application modules include:

- PERLND, the pervious land segment module;
- IMPLND, the impervious land segment module; and
- RCHRES, the receiving water module.

Utility data management modules include the following:

- COPY, a module for manipulating, aggregating or factoring a time series of data;
- PLTGEN, the module which creates specifically formatted files for plotting;
- DISPLY, the module which summarizes data and presents it in neatly formatted tables;

- DURANL, a module which performs a duration and excursion analysis; and
- GENER, a module which can perform a number of basic transformations of one or two time series.

HSPF has had widespread application in Canada and the United States since its earliest inception in the late 1950's. Restructuring, reprogramming and considerable augmentation has made the model package available for comprehensive watershed modelling exercises. Current computer hardware supports detailed watershed analysis with rapid simulation turnaround times. The model is not only applicable to agricultural assessments, but can be applied to a broad range of watershed types and issues.

The model is particularly valuable for the evaluation of the benefits of implementing best land management practices (BMPs) (Donigian *et al.*, 1983; Imhof *et al.*, 1983) or other activities which alter land runoff processes. The model represents the **state of the art** in watershed-based continuous simulation of hydrological and water quality processes. It performs computations on homogeneous pervious and/or impervious land segments and estimates delivery to streams. Further instream simulation is also possible.

The following is a list of advantages and relevant features of HSPF:

- HSPF provides a continuous simulation of the watershed hydrology, soil loss, sediment loading to streams, nutrient runoff and delivery and other chemicals (i.e., pesticides, fertilizers). While HSPF does not use the USLE (Wischmeier and Smith, 1965) specifically, several of the concepts are analogous.

- The model simulates the event based response, as well as the normal background behaviour of the watershed. Watershed behaviour is simulated for events such as rainfall, snowmelt, tillage, cropping, and chemical application. The short-term and long-term effects of these events can be simulated.

- Day by day and annual variations in climate are incorporated in simulations.
- HSPF allows for the assessment of BMPs which significantly alter the hydrologic cycle such as tile drainage, conservation tillage, and vegetative cover, because it simulates changes to the hydrologic cycle.
- HSPF can simulate the effect of instream remedial measures such as retention basins for sediment capture.
- HSPF can be used to assess the benefit of and ideal timing for planting, tillage and chemical application as they affect erosion and chemical loss.
- The model can simulate groundwater movement along with groundwater chemistry and temperature and determine the effects of these upon receiving stream, baseflow, quality, and temperature.
- HSPF can simulate long time periods, thus allowing for an assessment of changes in climate and slow changes in soil conditions.
- The model can accept additional hydraulic inputs such as that from irrigation and additional hydraulic losses due to groundwater pumping.

In addition to these capabilities, HSPF is a well organized data management tool that offers the user the following advantages:

- data requirements are similar to standard USLE requirements for soil loss, plus phosphorus and pesticide related data. Model parameter data (state variables and kinetic rate data) are usually readily available. In all cases, default values are provided, along with upper and lower limits to aid the user in parameter selection.

Time series data (meteorology, precipitation, air temperature, solar radiation, potential evaporation and wind speed) are required.

- The model can be run on a micro computer; BEAK currently has the model operating on a SUN UNIX based computer and DOS based PC's.

- HSPF has exceptional data management capabilities for time series data, including input data, intermediate parameters and output data. This feature enhances the users ability to calibrate the model, present output, and perform transformation on the data.

- The model can handle various area scales and is easily scaled upwards to large watersheds (i.e., 000's of km^2). Several detailed areas of particular interest can be evaluated within the framework of a large scale simulation if desired.

2.2.1.3 Model Input Requirements for HSPF

HSPF is a flexible land and water management tool which can be configured in a wide variety of ways. Model input information is dependent upon the output requirements. In the PWS the following primary output types were required:

- hourly streamflow at the outlet of each sub-watershed; and
- daily loads of TSS and TP at the outlet of each sub-watershed.

Secondary outputs added to this list:

- unit area runoff from each land segment on a daily basis;
- unit area erosion and phosphorus losses for each land segment on a daily basis;
- deposition and scour within drainage channels on a daily basis; and
- distribution of runoff and phosphorus transport by pathway (i.e., surface, groundwater, interflow, etc.)

In order to meet these needs HSPF requires dynamic meteorological input files including the following:

- precipitation rate;
- air temperature;
- wind speed;
- solar radiation;
- dewpoint temperature; and
- evaporation rate

This information is critical to maintaining a hydrological balance. In addition, various types of spatial information is required including the following:

- soil characteristics (i.e., infiltration rate, moisture holding capacity, bulk density);
- land cover characteristics; and
- surface slopes.

This information allows for a detailed spatial description of each watershed reflecting those conditions which are most critical to predicting water, soil and phosphorus movement.

In addition to meteorological and spatial data, information regarding watershed channel geometry and configuration is required as is information on the timing of agricultural activities such as plowing and harvesting which affect land cover and susceptibility to erosion.

Sections 2.3 and 2.5 outline the methods used to collect and incorporate input data in each HSPF application.

A time step of 30 minutes was chosen for all runs based upon the need for hourly output data and time step sensitivity tests. In these benchmark tests the full model was run for a period of one full year on a selected sub-watershed using time steps of 15 minutes, 30 minutes, 60 minutes and 120 minutes. Runs made at 15 minutes and 30 minutes compared very closely and were more accurate at predicting short term storm response than runs with longer time steps. Runs made at 60 and 120 minutes displayed considerable disparity and error in terms of short lived events. Thirty minutes was chosen as a compromise between run time costs and sensitivity.

The model was run for twelve months requiring simulation of snow accumulation and melting. Full year simulation is important in the Southern Ontario landscape which experiences frequent winter rains and associated erosion events as well as rapid snowmelt runoff events.

2.2.2 GAMES

2.2.2.1 General Description

GAMES and the phosphorus component, GAMESP, were developed at the University of Guelph, Ontario (Cook *et al.*, 1985). The models purposes are to predict soil and phosphorus loss by raindrop impact and fluvial processes and delivery of this material from field to stream in primarily agricultural settings. The model operates in seasonal and annual time frames and accommodates analysis of field and sub-field sized land elements. The models intended use is to identify critical erosion source areas and to provide a quantitative means of evaluating alternative soil conservation practices.

GAMES represents the landscape as a set of irregularly shaped polygons with each polygon or element being homogenous in terms of its land use, slope and soil characteristics. The land elements are linked to each other or to stream cells for the purpose of simulating overland movement and delivery from fields to streams. Soil and phosphorus which enters a stream cell is assumed to be delivered to the watershed mouth.

The erosion component is based upon the Universal Soil Loss Equation (Wischmeier and Smith, 1965). This well established relationship predicts sheet and gully erosion over the long term based upon long term average runoff conditions.

The delivery component of GAMES determines the portion of eroded soil which will be delivered to the edge of a land element. It assumes that delivery potential is directly related to overland flow velocity and inversely related to the length of the overland flow path. A land elements length, shape and ability to generate surface runoff are therefore important factors which are used to calculate soil delivery under conditions of a characteristic precipitation event.

GAMESP assumes that sediment bound phosphorus eroded and transported in surface runoff constitutes the majority of phosphorus loadings from a watershed. The soil attached phosphorus load is estimated from the concentration of phosphorus bound to the eroding soil and factored upwards by an enrichment ratio. The enrichment ratio accounts for the fact that the smaller particle sizes within the soil matrix are preferentially eroded and are more likely to be delivered to the streams. The smaller particle sizes have larger surface area to volume ratios and therefore tend to have higher attached phosphorus concentrations. This is especially true for clay sized particles.

2.2.2.2 Model Input Requirements

GAMES requires as input basic and usually readily available information. Necessary inputs fall into five categories, namely:

- rainfall - runoff information;
- soil characteristics relating to erodibility;
- land use, surface cover and roughness;
- hydrologic condition; and
- individual land element information relating to topography, location, and drainage.

GAMESP requires soil phosphorus concentrations for each watershed soil type. Model set up and calibration are discussed later.

Examples of meterological input data are included in Appendix A. Spatial data sources are discussed below.

2.3 Methods and Data Sources

2.3.1 Introduction

Both HSPF and GAMESP use irregularly shaped polygons linked to each other and the receiving water network to simulate watershed processes. Each polygon is unique from all surrounding polygons in terms of the unique combination of the following attributes:

- soil types;
- land use and management unit;
- slopes; and
- sub-drainage locality; or
- juxtaposition.

The two models are therefore suited to utilizing the some spatial conceptualization of the watershed. The way in which the models use this information and the computational processes are quite different.

2.3.2 Data Sources

The **soil** information for the sub-watersheds was surveyed and documented by Ecological Services for Planning (ESP) (ESP, 1990) shortly following sub-watershed selection in 1987. Many unique soil polygons were developed for each sub-watershed. For the purpose of modelling, these were reduced through lumping to those listed in Table 2.1. These soil series represent all soil series with significant areal coverage (>5 ha) for each sub-watershed pair. These series are unique from each other in terms of erodibility, particle size distribution, organic content, chemistry and water holding and transmission characteristics. Soil maps were digitized and stored in SPANS a commonly applied GIS.

Land use information sought for modelling related primarily to farming system and ownership. That is, the watershed was sub-divided according to its principal land use as follows:

- buildings;
- idle or pasture;
- conventionally tilled corn;
- reduced tillage corn;
- no-till corn;
- conventionally tilled winter grains;
- reduced till winter grains;
- no-till winter grains;
- conventionally tilled beans;
- reduced till beans;
- no-till beans;
- fallow;
- forested;
- conventionally tilled spring grains;
- reduced till spring grains; and
- no-till spring grains.

The PWS study areas were selected because farming systems in place in these areas was typical and conventional in all respects. This means, that at the onset of the study almost all of the farmland was used to grow corn, beans or grains in some typical rotation or it was pasture, idle, fallow or in some non-productive use (i.e., buildings, roads). Land uses selected for modelling included a conventional tillage system which would apply to most of the study area in the early years of the PWS and two classes of conservation tillage, reduced tillage and no-till, which appear in later years. These designations of land use were felt to encompass all likelihoods for the past and future and would allow for reasonable spatial descriptiveness of the land in terms of its erodibility-runoff and manageability.

In addition, **property lines** were incorporated in land use since individual fields are management units and the land use within will tend to change frequently as crops are rotated. Also, land ownership or management are key to the development of farm level plans which utilize the same modelled discretization of the study area.

Basemaps of land use were developed and modified each year of the study using the OMAF land use maps (OMAF, 1983) as a starting point. Land use for the 1989 year was digitized and stored in SPANS. Files for subsequent years were created by modifying the 1989 files. All land use data for 1989 to 1992 was compiled by watershed technicians.

Watershed **slope** maps were created manually by calculating slope grades from topographic maps and shading over the topographic map. This method was selected over digital analysis of terrain datasets since the slopes are simple in Essex and Pittock and relatively simple in Kettle Creek. Only one slope class was used for Essex sub-watersheds with an average slope of 0.4%. Kettle Creek sub-watersheds were described by five slope classes; 0 to 2%, 2 to 4%, 4 to 6%, 5 to 10%, and greater than 10%. Pittock sub-watersheds were described by three slope classes; 0 to 2%, 2 to 4% and 4 to 6%. All slope class data was digitized and stored as a SPANS file. Sub-drainage areas in the order of 10 to 50 hectares were determined from topographic maps where possible. In the low relief areas of Essex and Pittock, sub-drainage is not obvious from elevation maps and so visual inspection and interviews with farm managers was necessary. Subsurface drain maps are available for some limited areas (i.e., Essex test). However, all sub-watershed drains were physically examined and field notes were compiled indicating directions of surface water flow, locations of drop inlets and flow control and routing devices. Sub-watershed lines were digitized and stored in SPANS files.

All topographic data was readily available as OLS maps available from MNR at 1:10,000 scale.

2.3.3 Polygon Creation

SPANS files of soil series, slope class, land use and sub-drainage were overlain in a systematical manner to create a composite polygon scheme for each sub-watershed. At first these schemes contained thousands of unique polygons, some with areas of less than 0.1 hectare and artifacts of the overlay process. These model areas were systematically eliminated by limiting the minimum area of polygons to 0.1 hectares and providing a logical process for collapsing small polygons into neighbouring larger polygons. This process involved meeting the following conditions in order of priority:

- **Condition #1**, no land use detail could be lost or altered since land use boundaries often reflect ownership which should not be compromised in the watershed detail;
- **Condition #2**, polygons could be collapsed into neighbours which shared a common soil type if condition #1 is met;
- **Condition #3**, polygons could be collapsed into the neighbouring polygon which shared a common slope if no common soil type existed; and
- **Condition #4**, polygons could be collapsed into a neighbouring polygon sharing drainage areas if no common soil or slope existed.

This procedure created as many as 482 polygons (Kettle Creek test) and as few as 74 polygons (Essex Control) for each sub-watershed. Each polygon was unique from its neighbours, had an area of at least 0.1 hectares, and was as good a representation as possible for land use and ownership. The next most accurate parameter was soil series followed by slope and finally sub-drainage. Information on slope and sub-drainage were felt to be of less accuracy at the detailed spatial scale of a few metres as compared to land use and soil type which are either precisely determined or were very accurate. Therefore, the priority system employed accuracy of spatial data and land ownership as the two most important discretization parameters and slope and sub-catchment as the least accurate and important parameters. Figures 2.1 to 2.3 are examples of Kettle Creek test sub-watershed attribute maps.

2.4 GAMESP Watershed Discretization

GAMES (ver 3.00) provides gross erosion estimates for homogeneous polygons within the watershed. The polygons within a study watershed are determined through a process of attribute overlays (Cook *et al.*, 1985) as discussed above. The K-values (soil erodibility) were incorporated as series of ranges of K rather than as individual values in order to reduce the complexity of the final polygon map and remain within the number of K-values allowable for the input array by the model. The separate attribute maps were then created as indicated above.

After development of the modelling polygon maps, other data such as flow length, flow order and hydrologic soil group were determined. Flow direction was determined for each cell and then flow length was measured as the average length across the cell in the direction of the flow. Hydrologic soil group was inferred from the soil series as indicated in OMAF Publication #29 (Ontario Ministry of Agriculture and Food, 1986).

Data-set development, while generally similar with respect to approach, necessarily varied from watershed to watershed due to the differing characteristics associated with the three distinct landform types occupied by the watersheds. For example, identifying sub-watershed boundaries and slope lengths proved much more difficult for the flat Essex watersheds than it did for the Kettle Creek watersheds. GAMES, in its development, assumes that the slope length for a cell is identical to the slope and gradient of the concentrated flow pathway which surface run-off water follows. In the large majority of circumstances however, this is a poor assumption. By definition, the USLE's LS factor is measured from the top of an eroding slope to the point where deposition starts (Wischmeier *et al.*, 1978). In a typical field situation then, slope lengths would be measured along the side slopes to a concentrated flow pathway. Such slopes are often much steeper and can be shorter than the concentrated flow pathway which surface run-off follows as it traverses the polygon.

To enable a distinction to be made between the LS values used to estimate soil loss on the watershed and the flow or delivery pathways, "pseudo cells" or imaginary polygons were established in the GAMES data-set. Pseudo cells are created by sketching the primary concentrated flow pathways throughout the watershed and then splitting them up into a series of segments, or "pseudo cells", having negligible area but also possessing a slope gradient and slope length more representative of the pathway actually followed by run-off water. For the Essex watershed, the field scrape ditches installed by the farmers are regarded as the concentrated flow pathways. These pathways, or pseudo cells, are not shown on the polygon map, but the slope, length and Mannings "n" data associated with them are incorporated into the GAMES data-set and subsequently used for sediment delivery calculations. This also enabled the incorporation of more realistic values for L and S for the polygons.

2.5 Drainage Systems

Both of the study models require a simulated surface drainage system into which modelled constituents are routed.

The land slope directions and stream or channel locations and slope directions were located on sub-watershed maps. The information was developed from a combination of site inspections, elevation surveys, and interviews with land owners. This information was developed as part of the discretization of watershed catchments. From these maps, slope lengths and directions were determined so that the appropriate polygon linkages could be developed for both models.

GAMESP assumes that any soil or phosphorus which moves from land into a stream, channel or subsurface drain is delivered to the watershed outlet. Therefore the level of descriptive detail for the drainage system in GAMESP is limited to the length of the slope across the land to the stream and whether polygons are directly or indirectly (i.e., across downslope polygons) linked to the streams.

HSPF simulates material transport and behaviour in the streams and drains and therefore requires a detailed description of stream channels and the overall drainage network.

Figures 2.4 to 2.6 are schematics of the surface runoff network for each sub-watershed as input to HSPF. Individual reaches were selected so that physical characteristics were similar throughout. Reaches were divided where major changes occurred in slope and channel material or at confluences of major tributaries.

HSPF requires that reach parameters be provided so that water and material can be routed from land to the watershed outlet via the drainage networks. Table 2.2 lists the type of information necessary for receiving water network simulation of flow, sediment transport and phosphorus transport as used in this study.

Detailed descriptions of all characteristics were not possible and so estimates or default values were chosen in some cases. Since the objective for flow and material movement modelling was to simulate daily quantities, it was felt that reasonable estimates would suffice. Very accurate determinations of these parameters would only be required of short term simulation accuracy (i.e., minutes and hours) was necessary or if reach elevation and flood line prediction were required as output.

Some time of travel measurements were made in the main channels in order to provide a first estimate of flow velocity at known discharge rates. Channel widths were estimated from visual surveys and mean depths were estimated from knowledge of velocity, width, and flow rate. Stream reach roughness was estimated using Manning's equation.

Values used for reach characteristics and tables of depth/volume/surface area/flow rate are included in the example input files provided in Appendix B.

3.0 MODEL PROCESSES

3.1 HSPF Process Models

3.1.1 Data Management

HSPF uses a large time series data management system called the time series store (TSS). This centralized database contains all time dependant input and output information. Input information includes meterological data required to drive the hydrological cycle and affect other material process being simulated; as well as observed data for the watershed such as streamflows and water quality parameter concentrations at monitoring sites. This data group allows for comparisons of model predictions and observed conditions in the model calibration phase.

The TSS is also the site of model output storage. The model user decides what information, at what points in the watershed and at what frequency data will be stored for further analysis or for comparison with observed conditions.

Table 3.1 lists the general types of TSS input data and output data used in this study.

All meteorological data covered the period January 1989 to June 1992, 42 months in total. This information is discussed and listed in PWS Report #1. Examples are provided in Appendix A. All observed streamflow (1989 to June 1992) is discussed and listed in PWS Report #5. All observed watershed loads for 1989 to 1992 of suspended solids and phosphorus are discussed and listed in PWS Report #6. These data sets were complete and continuous and thus allowed for continuous simulation of all processes over a 42 month simulation period at a 30 minute time step.

The model user can perform several operations on TSS data including preparing plot files, performing transformations on data sets, frequency analysis and others. The HSPF User's Manual (Johanson, 1980) should be consulted for information on these capabilities.

In addition to time series data, model input includes state variables and process model parameters as well as run control information and linkage and network data. These data are stored in a user control input (UCI) file. The UCI contains hundreds of model factors which are adjusted in calibration and altered when model applications require adjustment to reflect alternative land and water management schemes. Run control information directs the model regarding time step, run duration, active and inactive subroutines, special actions which may occur during the run period, input and output requirements and TSS file locations. The UCI also contains all polygon and reach linkage and network description as well as complete characteristics for all polygons and reaches.

Very specific versions of the UCI are set up for each management scenario and calibration test run. An example UCI is included in Appendix B. The User's Manual is required to interpret the significance of some of the inputs.

3.1.2 Hydrology

Figure 3.1 illustrates the hydrologic cycle in simple terms. HSPF addresses all of these processes and accounts for all components of the watershed and stream water balance in a conservative manner.

The following excerpt is taken from the HSPF User's Manual and is a description of the model approach adopted in the module PWATER. This module simulates the water budget for pervious land segments.

The time series SUPY representing moisture supplied to the land segment includes rain, and snow when snow conditions are considered, rain plus water from the snowpack. Moisture is then available for interception. Interception storage is water retained by any storage above the overland flow plane. For pervious areas, interception storage is mostly on vegetation. Any overflow from interception storage is added to the optionally supplied time series of surface external lateral inflow to produce the total inflow into the surface detention storage.

Inflow to the surface detention storage is added to existing storage to make up the water available for infiltration and overland flow interact and occur simultaneously in nature. Surface conditions such as heavy turf on mild slopes restrict the velocity of overland flow and reduce the total quantity of runoff by allowing more time for infiltration. Increased soil moisture due to prolonged infiltration will in time reduce the infiltration rate producing more overland flow. Surface detention will modify flow. For example, high intensity rainfall is attenuated by storage and the maximum outflow rate is reduced. The water in the surface determination may also later infiltrate reoccurring as interflow, or it can be contained in upper zone storage.

Water infiltrating through the surface and percolating from the upper zone storage to the lower zone storage may flow to active groundwater storage or may be lost by deep percolation. Active groundwater eventually reappears as baseflow, but deep percolation is considered lost from the simulated system.

Lateral external inflows to interflow and active groundwater storages are also possible in section PWATER. One may wish to use this option if an upslope land segment is significantly different to merit separating it from a downslope land segment and no channel exists between them.

Not only are flows important in the simulation of the water budget, but so are storages. As states, soil storage affects infiltration. The water holding capacity of the two soil storages, upper zone and lower zone, in module section PERLND is defined in terms of nominal capacities. Nominal, rather than absolute capacities, serve the purpose of smoothing any abrupt change that would occur if an absolute capacity is reached. Such capacities permit a smooth transition in hydrologic performance as the water content fluctuates.

Storages also affect evapotranspiration loss. Evapotranspiration can be simulated from interception storage, upper and lower zone storages, active groundwater storage, and directly from baseflow.

Storages and flow can also be instrumental in the transformation and movement of chemicals simulated in the agri-chemical module sections. Soil moisture levels affect the adsorption and transformations of pesticides and nutrients.

Snow melt and accumulation processes are considered as indicated in Figure 3.2. Detailed meterological data is required for this component.

3.1.3 Soil Erosion

Figure 3.3 illustrates the soil erosion process and factors in effect. While wind erosion was not addressed in this study the various water related erosion considerations were made. The following excerpt from the User's Manual describes the modelling approach adopted in module SEDMNT which simulates the production and removal of sediment from land.

Removal of sediment by water is simulated as washoff of detached sediment in storage (WSSD) and scour of matric soil (SCRSD). The washoff process involves two parts: the detachment/attachment of sediment from/to the soil matrix of the transport of this sediment. Detachment (DET) occurs by rainfall. Attachment occurs only on days

without rainfall; the rate of attachment is specified by parameter AFFIX. Transport of detached sediment is by overland flow. The scouring of the matrix soil includes both pick up and transport by overland flow combined into one process.

3.1.4 Phosphorus Loss

Figure 3.4 is a flow chart of phosphorus movement in soil, soil water, and plants as simulated by HSPF. In each pervious land segment (PLS) the processes of phosphorus transport, plant uptake, adsorption/desorption, immobilization, and mineralization are addressed for phosphorus in four forms (i.e., organic, adsorbed, in solution, and in plant tissue). Surface layer phosphorus in any form except in plants may be transported with surface runoff to streams. Phosphorus in all layers may be leached by interflow or groundwater and transported to streams as subsurface phosphorus loadings.

3.1.5 Material Transport

Surface and subsurface water and associated suspended solids and phosphorus are transported to agricultural channels and natural streams according to the linkages specified for each sub-watershed.

Figure 3.5 illustrates a typical headwater reach which receives inflow from precipitation; diffuse sources, and upstream tributaries. Outflow could be from evaporation and discharge at the downstream end of the reach. Several outlets are possible. Instream transformations of interest in this study include settling and scouring of particulate material. Phosphorus was treated as a conservative parameter because it was felt that instream processes had little likelihood of significantly altering stream loads especially in the long term.

Methods for estimating flow through a reach is user specified in HSPF however, in the PWS a natural system was simulated in which outflow from a reach is a function of reach volume and time. Based upon velocity and roughness, shear stresses at the reach bottom are calculated and used to determine settling and scour potential.

Suspended solids are subdivided into three fractions. One of these represents non-cohesive inorganic solids (i.e., sand). Transport of this fraction is modelled through the use of transport capacity which is directly related to kinetic energy in the stream and particle dimensions.

The other two fractions represent the cohesive particles (i.e., silt and clay) which settle or are scoured depending upon the threshold shear stresses for these particles and the calculated shear stress in the stream. Of course, shear stress is related to stream velocity and surface roughness. Therefore, the processes affecting cohesive and non-cohesive particle behaviour are dynamic and site specific. Some reaches tend to be continually flushed while others act as sediment traps. Some reaches accumulate material at times and are scoured of this material during high flow periods.

3.2 GAMES Model Processes

GAMES was chosen as the screening model for use in determining appropriate remedial cropping and tillage measures for the watersheds. GAMES adapts the Universal Soil Loss Equation for use in watershed applications.

The USLE states that:

$$A = RKLSCP$$

where: A = longterm average annual soil loss
R = rainfall and runoff factor
K = soil erodibility factor
LS = length/slope factor
C = cover and management factor
P = the erosion control support factor (Wischmeier & Smith, 1978)

To date, the USLE is still the most effective tool or model for estimating soil loss from agricultural land.

In addition to providing erosion estimates, GAMES also models delivery of the eroded sediment to the watershed outlet. Given that GAMES does not actually model the hydrology of the watershed, the approach used is highly empirical. This empirical relationship may be calibrated to a certain degree if sediment loading data at the watershed outlets is available. Values for observed loads are used in the model to calculate the value A in the equation:

$$DR = A \times (t)^B$$

where: DR = Delivery Ratio
t = time to delivery
and A and B are empirical constants.

By generating a calibrated value of A, the GAMES model can provide estimates of erosion and sediment delivery that more accurately reflect existing conditions. The values of A calibrated for each watershed also provide a basis for comparison of delivery ratios between the main watersheds and between the test and control sub-watersheds.

Finally, GAMES (ver 2.11) also incorporates algorithms which can estimate the fraction of phosphorus which is associated with the delivered sediment. The relationship is as follows:

sediment associated phosphorus (kg/ha) = (sediment load (kg/ha)) x (phosphorus content of surface soil (μg/g)) x (phosphorus sediment ratio).

Two options are available in GAMES for specifying the phosphorus content in the surface soil. The first option allows the total phosphorus content of the homogenous cells to be specified directly if estimates are known. The second option calculates the total phosphorus content of the surface soil by means of a regression equation presented by Spires and Miller (1978) which relates phosphorus content to percent organic matter content and $NaHCO_3$ extractable P for specific crops in specific regions (from Ontario Soil Test information). For modelling of the SWEEP watersheds, the second option is used since surface P estimates are not available for each polygon.

The phosphorus enrichment ratio for each polygon is calculated by the following equation:

$$\text{PER} = a \times (\text{SEDHA})^{-b}$$

where: SEDHA = sediment delivered from cell to cell or cell to stream (kg/ha),
a and b = empirical parameters.

Like the sediment delivery relationship, the parameters a and b can be calibrated if measured phosphorus values are available from water samples obtained at the watershed outlets.

In reviewing the theory on which GAMES is based, arguments can be made which discount it as being a model suitable for conservation planning purposes. First, since the GAMES model is based on the USLE, it is restricted to model only sheet or rill erosion. It does not effectively model the sediment load originating from gully erosion. Accordingly, the impact of some structural control measures implemented in the watersheds can not be modelled. Simplifying assumptions must be made to incorporate their effects on erosion. In addition to being limited in the ability to model some structural changes, the capacity of GAMES to model the impact of conservation tillage practices is also somewhat limited primarily due to restricted availability of Ontario based data for conservation practices. The C-factors used to represent crop practices in the modelling of the SWEEP watersheds are based on Ontario data where available. Where Ontario data for C-factors is not available, interpolation of data from neighbouring New York and Michigan States is used.

Overall, on a practical level and in comparison to a number of other available watershed erosion models, it seems that GAMES provides the optimum combination of required output and detail necessary for the long-term nature associated with the task of conservation planning.

Despite GAMES' basic suitability as a tool for comparison of the effects of conservation alternatives at a watershed level, a number of modifications must be made in order to customize the model for its applicability to the SWEEP PWS. To begin, the allowable input array sizes for C-factors, Mannings n values and soil K factors need to be expanded to facilitate the higher degree of detail needed to differentiate the various tillage and cropping practices in effect within the watersheds. Next, the software must be modified to allow for the identification of each polygon with respect to the farm and field in which it is located. Source code is also added to enable the creation of a pass file that could be used as input for new software. This new software was prepared to assist conservation planners in interpreting and handling the GAMES output or results at a farm and field level; the level at which conservation planning ultimately takes place. Finally, the program has been adapted for use on a Sun 360 workstation.

4.0 MODEL TESTING

4.1 HSPF Calibration

4.1.1 General

Calibration of HSPF is a systematic process because there are several degrees of freedom involved in the various processes modelled. The logical sequence employed in the PWS targeted the following output types in a stepwise manner:

- total sub-watershed daily flow rate during the winter snow accumulation and melt period (December to April);
- daily total runoff during peak flow periods (i.e., events);
- daily total runoff during baseflow periods;
- daily total solids loss during winter periods;
- daily total solids loss during peak flow periods;
- daily total solids loss during minor events and baseflow periods;
- daily total phosphorus loss during winter periods and peak flow periods; and
- daily total phosphorus loss during baseflow and minor events.

This procedure ensures that acceptable prediction be achieved at each phase, before progressing to another parameter, often one which is dependant upon the first. For example, soil loss and transport, is highly dependant upon the volume and rate of surface overland runoff. Therefore the model is required to accurately predict surface overland runoff over the year on a daily basis before accurate predictions of stream suspended solids can be expected. In effect, each step is dependant upon the one prior to it. Within each step there is also a logical approach to input parameter calibration. This involves a sensitivity analysis of all relevant input parameters to quantify the parameters importance and to identify the effect of varying each parameter. Once the parameters have been ranked, then successive runs are made to refine their value until there is good correspondence between observed and predicted flow and water quality data.

Several intermediate output variables were examined in the process to ensure that predictions were reasonable as well as accurate. This evaluation is necessary in order to eliminate a situation wherein the model predictions appear to be accurate but are, actually, in agreement with observed conditions by coincidence. For example, the model may appear to predict the runoff from a storm event reasonable accurately but on further investigation it could be that the distribution between surface and sub-surface flow is unreasonable. This condition would lead to errors in soil transport prediction at a later phase of calibration and must be flagged and corrected at the earliest time possible.

The true test of the model is its ability to predict daily output (i.e., flow, TSS and TP) over a full year. Model output was compared to observed conditions by examining daily total flows and loads and by comparing total cumulative flow and loads over a year. In this way, both the day-by-day dynamic response of the system and the overall event-by-event and yearly mass balances were evaluated. The monthly correlation information assisted in comparing results from run to run. Monthly correlation values were calculated by comparing predicted and observed sums of flow or load on a day-by-day basis in terms of an r^2 value. A very high r^2 value implies that either the agreement was excellent or that portions of the observed data were below a threshold value and direct comparison is invalid. In the case of streamflow, the threshold value is equal to the lowest reported streamflow of 0.005 m^3/s or 43 m^3/d. Precipitation was also included on daily total output plots in order to aid interpretation.

Tabular output such as that illustrated by Table 4.1 was also used continuously as an aid to calibration. In addition, plots of daily total runoff by component (i.e., surface, interflow and groundwater) and corresponding component plots for soil and phosphorus loss were also used to evaluate model runs in calibration.

4.1.2 Essex Sub-Watersheds Calibration

Figure 4.1 to 4.12 show the daily total predicted and observed runoff, soil loss and phosphorus losses for the Essex sub-watersheds for the 1989 calendar year.

Observed streamflow for both sub-watersheds was clearly reflected by the simulations (Figures 4.1 to 4.4). The cumulative total runoff in both cases is very close through the year except for a mid June event which could not be accurately reflected. Precipitation and streamflow are difficult to accurately measure during extreme event periods and therefore observed data may be inaccurate, thus to some extent accounting for this discrepancy. This is reflected in soil and phosphorus loss predictions as well.

In terms of runoff, the seasonal distributions are accurate while on a daily basis the model is shown to be capable of simulating wide swings in streamflow, over four orders of magnitude. Snowmelt and accumulation are particularly difficult to simulate because of the additional degrees of freedom, and the lack of detailed observed data for the snowpack. In general, the total runoff from the snowpack is captured although in some cases the timing of the event differs by a few days (i.e., see mid March 1989). Low streamflow periods contribute very little to the overall balance of water, soil or phosphorus and are therefore a low priority in this exercise. However, generally good agreement has been achieved for low flow streamflow periods.

Soil loss predictions are illustrated in Figures 4.5 to 4.8. Note that while total cumulative soil loss and event loads are reflected accurately by the model, the baseflow loads are not. This is due to the fact that the baseflow TSS concentration is highly variable and average values have been used in loading calculations. Therefore, observed datasets are not precise at this low flow range. Also, the model has not been set up to model the non-settleable fraction of solids (i.e., organics) which may prevail in the TSS makeup during low flow periods. The implications of this are inconsequential since baseflow loads of TSS do not contribute significantly to overall total loads, are partially due to algal and other organic material which is not the focus of this study, and the observed data is somewhat in question due to a limited focus upon baseflow monitoring and analysis in the PWS.

Phosphorus loss predictions are good in the short and long terms. The good correspondence here confirms that runoff water distributions between surface and subsurface flow as well as soil loss predictions are reasonable since phosphorus prediction relies upon the accuracy of these components.

Table 4.2 lists the most sensitive model input parameters and the value or range of values determined from calibration. It was found that some parameters were dynamic, responding to antecedent conditions. These included infiltration rate (INFILT), lower zone water storage capacity (LZSN) and groundwater recession (AGWRC). These parameters required major changes through the year depending upon the general state of the groundwater reserves or the time since the antecedent rainfall. If constant values had been used, the total cumulative runoff could have been calibrated but there would be discrepancies on a day-by-day basis and these would have been reflected in concomitant soil and phosphorus transport.

Several other parameters were allowed to vary by month to reflect vegetative conditions or by land use, soil type, tillage practise or soil layer as appropriate as indicated in Table 4.2.

Other parameters determined from calibration can be seen in the example UCI files presented in Appendix B.

4.1.3 Kettle Creek Sub-Watersheds Calibration

Figures 4.13 to 4.24 show the daily total predicted and observed runoff, soil loss and phosphorus losses for the Kettle Creek sub-watersheds for the 1989 calendar year.

Observed streamflow for both sub-watersheds was accurately captured in simulations. The cumulative total runoff for both sub-watersheds is very close through the year except for a late March snowmelt period which could not be accurately reflected. As mentioned earlier, during extreme event periods (i.e., high flow, precipitation) observed data may be less accurate and so the reason for discrepancies between predicted and observed data may not be limited to a simple cause. The cause may be a combination of field data or model error.

In terms of runoff (Figures 4.13 to 4.16), the seasonal distributions are accurate while on a daily basis the model is shown to be capable of simulating wide swings in streamflow over four orders of magnitude. Snowmelt and accumulation are particularly difficult to simulate because of the additional degrees of freedom, spatial heterogeneity of snow accumulation and the lack of detailed observed data for the snowpack. In general, the total runoff from the snowpack is captured although in some cases the timing of the event differs by a few days (i.e., see mid March 1989). Low streamflow periods contribute very little to the overall balance of water, soil or phosphorus and are therefore a low priority in this exercise. However, generally good agreement has been achieved for low flow streamflow periods.

Soil loss predictions are illustrated in Figures 4.17 to 4.20. Snowmelt periods display some discrepancies although the total mass of soil loss over the season is accurately simulated.

As noted with Essex, baseflow periods are not modelled accurately since organic solids are not simulated. The consequences of this are minor.

Kettle Creek control TSS losses (i.e., 12 tonnes) were only about one-quarter of those for the test watershed (i.e., 43 tonnes) over the whole of 1989. This is largely due to a large solids deposition zone in the central area of the control sub-watershed. This area was observed to trap a significant portion of the soil transported into it from upstream. This phenomenon was simulated using particle settling in the relevant reaches and required additional calibration efforts.

Phosphorus losses (Figures 4.21 to 4.24) have been calibrated reasonably accurately with the exception of the snowmelt period. Total annual TP losses are close to observed level in both sub-watersheds.

Phosphorus levels in the central sub-watershed were not strongly influenced by the deposition areas since phosphorus in stream is largely transported in a soluble form or attached to the smaller less settleable soil particles.

Table 4.3 lists the most sensitive model input parameters and the value or range of values determined in calibration. A more complete listing of final calibration values is provided in the example UCI for Kettle Creek in Appendix C.

4.1.4 Pittock Sub-Watersheds Calibration

Figure 4.25 to 4.36 show the daily total predicted and observed runoff, soil loss and phosphorus losses for the Pittock sub-watersheds for the 1989 calendar year. Corresponding output in tabular form is provided in Appendix C.

Observed streamflow (Figures 4.25 to 4.28) for both sub-watersheds was accurately captured in simulations. The cumulative total runoff for both sub-watersheds is very close through the year except for minor discrepancies through the snowmelt period.

In terms of runoff, the seasonal distributions are accurate while on a daily basis the model is shown to be capable of simulating wide swings in streamflow over three orders of magnitude. This model is capable of reflecting the transition from wet to dry with no significant runoff for two months and then a return to water conditions in the late fall. In general, the total runoff from the snowpack is captured although in some cases the timing of the event differs by a few days (i.e., see mid March 1989). Low streamflow periods contribute very little to the overall balance of water, soil or phosphorus and are therefore a low priority in this exercise. However, generally good agreement has been achieved for low flow streamflow periods.

Soil loss predictions are illustrated in Figures 4.29 to 4.32. Snowmelt periods display some discrepancies although the total mass of soil loss over each season is accurate.

As noted with the other watersheds, baseflow periods are not modelled accurately in terms of instream TSS concentration since organic solids are not simulated. The consequences of this are minor in overall loads.

Pittock test and control TSS losses for 1989 (i.e., 20 tonnes) were similar in both sub-watersheds. There are no significant sediment deposition areas in the Pittock drainage system and so instream processes were not a factor here as in Kettle Creek.

Phosphorus losses (Figures 4.33 to 4.36) have been calibrated reasonably accurately with the exception of the snowmelt period. Total annual TP losses are close to observed level in both sub-watersheds at about 160 kg for 1989. Baseflow phosphorus concentrations are accurate and rapid fluctuation is over two orders of magnitude in daily loads over a few days is simulated.

Phosphorus levels in the central sub-watershed were not strongly influenced by the deposition areas since phosphorus in stream is largely transported in a soluble form or attached to the smaller less settleable soil particles.

Table 4.4 lists the most sensitive model input parameters and the value or range of values determined in calibration. A more complete listing of final calibration values is provided in the example UCI for Kettle Creek in Appendix C.

4.2 Validation of Model Accuracy

4.2.1 Procedure

In order to validate the model and the input parameter values set during calibration, the model runs were extended through the next full year for the test sub-watersheds.

Actual 1990 meterological data was used as input. Adjustments were made to the PLS areas to reflect the changes in the land use from 1989 to 1990. As in 1989, it was necessary to systematically adjust selected winter and summer parameters to reflect changing conditions.

These adjustments were primarily limited to infiltration rate (INFILT) which is highly variable in time for several reasons, lower zone storage (LZSN) which is dependant upon the depth to groundwater and is not monthly variable in HSPF, and groundwater recession rate for the same reasons as LZSN. All other parameters remained as in the 1989 runs. All parameters which varied monthly were left untouched.

The period of 1990 was felt to be the best test case since it allows for a continuous simulation from 1989 to 1990. All predicted conditions of state at the end of 1989 become starting conditions in 1990 and so fundamental errors would tend to be compounded in the longer term. Furthermore, 1990 was a wetter year and so a wider range of conditions would be included as a further test of the model.

4.2.2 Essex Validation

Figures 4.37 to 4.42 display validation run results for 1989 and 1990 for Essex test sub-watersheds. Validation runs were conducted for total daily flow, and loads of TSS and TP. Two year cumulative plots of flow and loads are presented.

The wetter conditions of 1990 were accurately predicted by the model for this sub-watershed in terms of total cumulative runoff and daily total runoff without requiring fundamental changes in the model or major model parameters. Correlations (r^2) for 1990 were only below 0.5 in March, a difficult period to simulate due to the complications of snowmelt. Predicted soil and phosphorus losses were equally accurate especially in terms of total annual mass. Based upon the good correspondence between the 1990 predicted and observed databases the model is considered validated.

The total runoff, soil loss and phosphorus losses in 1990 in the Essex test sub-watershed were observed and predicted to be about 2.9, 1.4 and 2.1 times higher than in 1989 and thus satisfy the conditions of a validation.

4.2.3 Kettle Creek Validation

Figures 4.43 to 4.48 display the result of validation runs for 1989 to 1990 for Kettle Creek test. The daily total flows, and loads are shown as well as the two year cumulative plots of quantity.

It is clear from the cumulative plots (Figures 4.44, 4.46 and 4.48) that 1990 was a year of much higher runoff than in 1989. This is true in all parameters with increase of from six times for total runoff to fifteen times more phosphorus and eighteen times more soil loss in 1990. These increases are much greater than those in Essex test sub-watershed.

All parameters were successfully validated with, as mentioned, some time dependant adjustments to a few selected parameters. No adjustments were required for major model parameters. The predictions for 1990 were clearly reflective of observed total outflow and loads. Since these conditions differed greatly from those in 1989 this is a valid test of model accuracy. As in 1989 the largest discrepancies occur during snowmelt periods. However, despite the inaccuracies in timing, the total masses are generally accurate. Based upon this result, the HSPF model for the Kettle Creek area is considered validated.

4.2.4 Pittock Validation

Figures 4.49 to 4.54 display the result of validation runs for 1989 to 1990 for the Pittock test sub-watershed. The daily total flows, and loads are shown as well as the two year cumulative plots of mass export.

As was the case in Essex and Kettle Creek, significantly higher rates of runoff and material loss occurred in 1990 compared to 1989 in Pittock. About three times more runoff occurred in 1990 than in 1989. The corresponding increases for soil and total phosphorus were observed to be 2.8 times higher and 2.4 times higher respectively. Higher summer rains in 1990 resulted in several summer runoff and erosion events.

All parameters were successfully validated. No changes were required to major model parameters to achieve good correspondence in 1990. The process required some time dependent adjustments to selected parameters, Since 1990 differed from 1989 in terms of rainfall and runoff, the validation test is reasonably rigorous.

Total predicted and observed annual flow and mass transport of soil and total phosphorus were in good agreement. Daily total values were reasonably good for the high flow periods. baseflow solids loss is not well represented. Baseflow total phosphorus predictions were reasonably good.

4.3 GAMES

4.3.1 Sensitivity Analysis

The GAMES model of erosion and sedimentation requires input for fourteen (14) parameters that reflect the existing conditions and estimated process rates used in modelling. Each value entered for any of these parameters has some impact on the predicted erosion and sedimentation generated by the GAMES model. In order to determine the sensitivity of the model to parameter changes, several runs can be conducted, each with known changes in a single specific input parameter. Most of the parameters in question reflect physical characteristics inherent to the modelled watershed (soil type, length and direction of surface flow, area and slope) and they remain relatively constant. Only those parameters reflecting the specific crops grown at a given point in time or the concurrent intensity of rainfall are independent of the watershed's physical make-up and also relatively variable over time. These parameters are therefore the best to alter for the purpose of sensitivity analysis since they are prone to the greatest degree of actual change. The Rainfall Erodibility Index (R) was chosen from the three suitable parameters for this sensitivity analysis.

The Kettle Creek test sub-watershed conditions of 1990 were randomly chosen for GAMES Model sensitivity analysis. The rainfall erodibility index ($R = 95$) was both increased and decreased by 33 % ($R=126.7$ and $R=63.3$, respectively) for two otherwise identical input files.

The outputs from the GAMES model sensitivity runs are presented in Table 4.5. All output variables (erosion, sediment and phosphorous delivery) exhibit significant change as a result of changes in the rainfall erodibility index. The smallest change occurring as a result of an increase in R from 95 to 126.7 is in gross erosion. This small degree of change (8.2 % increase) is due to the law of diminishing returns associated with erosion driven by precipitation. At $R=95$, a large amount of the erodible material has already been removed. The material that remains requires relatively large increases in R in order for it to be removed. However, at $R=63.3$, a relatively small proportion of erodible material has been removed and an increase to $R=95$ is reflected by a large increase in the amount of material eroded (Table 4.5). The pattern for change in sediment delivery, as a result of changes in R, is the same as that for erosion except that the degree of change in erosion and delivery is greater after both the increase and decrease of the original R. Delivery of total phosphorous responds to changes in R in the same manner as sediment delivery since the majority of the total phosphorous is sediment bound.

4.3.2 GAMES Calibration

The GAMES model, when run in analytical mode, generates an optimized value of the variable A of the equation;

$$DR = A \times (t)^B$$

where DR is the delivery ratio (total sediment delivered to stream in proportion to total erosion) and t is the time component (related to the distance of each cell from the stream). The parameter B is dependent on individual cell characteristics while the parameter A is reflective of the watershed as a whole. A higher value of A equates to a higher delivery ratio for the watershed.

The optimized values of A are based on standard model inputs (slopes, soil types, crop type, etc) in conjunction with observed loads, measured at the watershed outlets. The model is forced to adjust the parameter A in order that the predicted sediment load agrees with the observed load. In generating these values of A, the rainfall factor (R) specific to the time period of concern must also be incorporated into the GAMES input file, since precipitation is the driving force leading to the observed loads. The values of R used in this instance were calculated by adjusting the longterm normal R value for each watershed in proportion to the ratio of measured precipitation to longterm normal precipitation. Lower than normal precipitation would result in a proportionally lower than normal R. While this does provide a general indicator of the year to year changes in R, it also results in a degree of error associated with R, and hence also with A, since the intensity and duration of all individual rainfall events are not involved in the calculation, as they normally would be. Accordingly, year to year changes in A may be over or under estimated. However, relative comparisons of A between watersheds and sub-watersheds within any given year still have a high degree of reliability since all calculations of A share the same error (over or under estimation) associated with the rainfall factor.

4.3.3 Longterm Predictions

Sediment

GAMES can be run to simulate different management scenarios. To obtain longterm general predictions from the model, a general value for the factor A (affecting delivery ratio), rather than an A value calibrated from observed levels of sediment delivery, is incorporated as an input parameter. In addition, a longterm normal precipitation factor is used rather than a precipitation factor based on measured precipitation events during a specific period of time. Such general model runs yield longterm erosion and sedimentation rates that reflect the specific site conditions, such as crop and tillage types, under otherwise general, non-specific, longterm conditions. These model outputs do not accurately reflect actual sediment delivery at the watershed outlets but do serve well as a basis for general comparison of the watersheds and sub-watersheds. Changes over time in estimates of erosion and delivery of sediment and phosphorous are especially useful, since the only changes incorporated in the model inputs involve changes in land management practices (tillage type, crop types, buffer strips).

Table 4.6 provides longterm general results that reflect the conditions of the three paired study watersheds during the years 1989, 1990, and 1991.

Total predicted gross erosion, as predicted by GAMES remains relatively constant for the Essex control sub-watershed throughout the period of study, ranging from 977.9 tonnes to 999.6 tonnes (Table 4.6). Over the same time period, estimated total gross erosion for the test sub-watershed slowly decreases from 1530.8 to 1410.2 tonnes, a 7.8% drop. Comparison of these two sub-watersheds with respect to unit area total gross erosion reveals that the test and control are very similar in erosion rates (differing by less than 1%) at the onset of the study in 1989. By 1991, predicted unit area total gross erosion in the test sub-watershed is 8.5 % lower than in the control sub-watershed. This apparent trend is predicted as a result of conservation management implementation in the test sub-watershed.

In contrast to total gross erosion, GAMES estimates of sediment delivery for both the test and control sub-watersheds increases over the period of study (Table 4.6). In the control sub-watershed, total sediment delivered to stream increases 33.4% from 1989 (258 tonnes) to 1991 (345 tonnes). In the test sub-watershed, estimated total sediment delivery initially decreases for 1990 to 90.3% of 1989 levels, but subsequently increases for 1991 to 6.5% above the 1989 level.

Comparison of unit area sediment delivery indicates that, although both the test and control sub-watersheds exhibit an increase in sediment delivery from 1989 to 1991, the test sub-watershed does improve with respect to the control. For 1989, the GAMES estimate of unit area sediment delivery for the test sub-watershed (0.68 t/ha) is 73.9% of the estimated sediment delivery of the control (0.92 t/ha) (Table 4.6). For 1991, the unit area sediment delivery of the test sub-watershed (0.73 t/ha) is only 59.3 % of that of the control sub-watershed (1.23 t/ha).

GAMES longterm estimates of erosion and sediment delivery for the Kettle Creek watershed are also presented in Table 4.6. Estimates of total gross erosion for the Kettle Creek control sub-watershed exhibit an increase over the period of study. For 1989, the estimated total gross erosion for the control sub-watershed is 4297.5 tonnes. For 1991 conditions, this value increases by 14% to 4902.0 tonnes. The test sub-watershed exhibits a concurrent decrease in estimated total gross erosion. For 1989, estimated total gross erosion is 4243.3 tonnes, decreasing by 21% to 3356.1 tonnes in 1991.

Unit area gross erosion estimates for the two sub-watersheds at Kettle Creek indicate that the test sub-watershed consistently improved with respect to the Control sub-watershed between 1989 and 1991. Test estimated unit area erosion is 85% of that of the control in 1989, 75% in 1990, and only 59% in 1991. As with Essex this apparent trend is predicted to result from increased implementation of conservation farming systems.

GAMES estimates of sediment delivered to stream for Kettle Creek show a similar pattern to estimates for total gross erosion. Between 1989 and 1991, the total sediment delivery in the control sub-watershed increases by 29% while sediment delivery in the test decreases by 21% (see Table 4.6).

Comparison of predicted unit area sediment delivery values for the Kettle Creek sub-watersheds illustrates that the test sub-watershed has greatly improved with respect to the control (Table 4.6). For 1989, estimated unit area sediment delivery in the test is 18% higher than that of the control. For 1990, unit area sediment delivery is higher in the control by 22%. By 1991, unit area sediment delivery in the control sub-watershed is 40% higher than in the test sub-watershed.

The GAMES longterm general estimates of erosion and sedimentation for the Pittock watershed indicates that total gross erosion in the test sub-watershed drops slightly (8.7%) from 1989 to 1990 and then, for 1991, increases back to a level only 4% lower than that of 1989. The total gross erosion in the control sub-watershed remains comparatively stable, increasing by only 3% over the study period (1989 to 1991). No trend in time is apparent here.

Average gross erosion values for the Pittock sub-watersheds show that the test sub-watershed consistently has lower unit area erosion levels during the study period (Table 4.6). The lowest estimate of unit area erosion found for the test watershed, in comparison to the control, occurs for 1990 when the value for the test (4.9 t/ha) is only 63.2% of that of the control. For 1989, unit area gross erosion in the test reaches a maximum of 69.9% of that of the control, and for 1991 it is 65.3% of the control sub-watershed unit area erosion level. Clearly, Pittock control is inherently more susceptible to erosion than Pittock test.

The delivery ratio presented in Table 4.6 is simply the total sediment delivered to the stream as a percentage of the total gross erosion. The Essex watershed has the highest delivery ratios of the three watersheds in question, averaging 25.3% for both test and control compared to 5.71% for Kettle Creek and 2.46% for Pittock.

GAMES delivery ratio for Essex control increases in each year throughout the study period (25.8% for 1989, 31.2% for 1990, and 34.7% for 1991). For the Essex test sub-watershed, delivery ratio decreases initially from 1989 (19.5%) to 1990 (18.0%), but then increases in 1991 to a maximum value of 22.4% (Table 4.6). For every year, estimated delivery ratio for the test was lower than for the control. On average, the test delivery ratio is only 65.8% of that of the control sub-watershed. Essex delivery ratios are high because the soil is composed of very fine particles in the clay range and this material resists settling. Therefore a high portion of eroded material is conducted to open channels during storm events. Also the drainage system in Essex is well developed and therefore the overland flow path is generally shorter than in Kettle Creek or Pittock sub-watersheds.

For the Kettle Creek watershed, delivery ratios for the control sub-watershed remain relatively stable while those of the test fluctuate over time (Table 4.6). Test delivery ratios initially drop 27% from 1989 to 1990 but then increase 13% for 1991. While the test delivery ratio remains slightly higher than that of the control throughout the study period, the degree of difference between the test and control sub-watersheds is lower in 1991 than in 1989.

The Pittock watershed exhibits very low delivery ratios that are roughly equivalent for the test and control sub-watersheds. The delivery ratio for the test is lower than that of the control for 1989, higher for 1990, and virtually equivalent for 1991.

The GAMES model can be used to estimate erosion and sediment and phosphorous delivery on a seasonal basis as well as on an annual basis. GAMES seasonal runs take into account seasonal differences in soil structure and permeability (which effect soil erodibility), distribution of precipitation throughout the year, and the progression of crops throughout the growing season (affecting cover and surface roughness). For the purposes of the PWS, the seasons have been categorized as follows; Winter (January to March), Spring (April to June), Summer (July to September), and Fall (October to December). While these periods do not precisely define periods of seasonal change in each watershed during each year of the study, they do approximate continuous periods of similar conditions (climate, soil, crop cover) that affect erosion. Accordingly, the output from the GAMES model seasonal runs are approximate in this regard and reflect the trends due to seasonal changes in erosion and delivery.

The GAMES longterm seasonal estimates of erosion and sedimentation are summarized in Tables 4.7 to 4.9. Several consistent trends appear in the predictions of erosion and delivery for the three watersheds. Most noticeably, in all watersheds the erosion predicted for the spring and summer seasons makes up a large majority of the total erosion for each year. Spring and summer erosion makes up an average of 70.4 % of the annual total for the control sub-watershed over the three years of the study and 70.0 % for the test. For the Kettle Creek watershed, the equivalent proportions are 76.8 % for the control and 76.6 % for the test. Predicted spring and summer erosion for Pittock comprise an average of 75.3 % of the annual total for the control and 77.9 % for the test. With respect to sediment delivery, the estimated values for the spring season alone account for over 90 % of the annual total for all of the paired watersheds (Tables 4.7 to 4.9). Therefore, while erosion is predicted to occur throughout the year with a bias to the non-productive seasons, sediment delivery is highly specific to spring due to hydrological conditions as well as susceptibility to raindrop impact.

Comparison of GAMES seasonal estimates of unit area erosion and sediment delivery between test and control sub-watersheds also reveals some consistent patterns. All three watersheds exhibit unit area erosion that is greater for the control than for the test in all seasons in all years of the study. The margin of difference between control and test sub-watersheds is least for Essex (Table 4.7) where predicted erosion for the test is 89.1 % of that for the control in spring and 92.4 % in the summer (the two seasons contributing most of the erosion). The corresponding values for the Pittock watershed (Table 4.9) are 77.8 % for the spring and 84.6 % for summer. For Kettle Creek the equivalent proportions are 74.2 % for spring and 74.5 % for summer (Table 4.8).

Predictions for unit area sediment delivery in the Essex watershed (Table 4.7) are also higher for the control in every season in every year. Spring unit area sediment delivery (accounting for a very large majority of the total) for the test is an average of only 72.4 % of that of the control for all three years of the study. Longterm predictions of unit area sediment delivery in Kettle Creek are also higher for the control in the spring of each year of the study, the test exhibiting an average of only 76.8 % of the unit area sediment delivery of the control over the period of study. Sediment delivery during the other seasons is not consistently higher in either of the Kettle Creek paired sub-watersheds. The Pittock watershed exhibits unit area sediment delivery that is lower (by 39.6 %) in the test for 1989 but is higher in the test for 1990 (by 12.3 %) and 1991 (by 25.3%). As with Kettle Creek, the comparative relationship between the test and the control for other seasons shows variability from year to year.

The Essex test sub-watershed displays no clear trend to improvement over the three year period, however, Kettle Creek and Pittock test sub-watersheds do appear to have small reductions in total erosion, year-by-year. The comparison between test and control sub-watersheds displays some small improvements in test sub-watersheds over the course of three years. This is due to the implementation of conservation farming systems which are reflected by model input parameters. The degree of implementation in 1990 and 1991 is not sufficient to result in dramatic differences over 1989. Control sub-watersheds tend to display consistent results and clearly they have not experienced any degree of improvement.

Optimized values of A for the PWS sub-watersheds, presented in Table 4.14, exhibit a high degree of variability, ranging from 2.01 to 83.8. It is expected that A should remain relatively constant for each watershed, fluctuating slightly over time due to changes in land management practices. As stated above, the unexpected temporal variability of A may well reflect the error inherent in the annual rainfall factors used in generating A.

The highest values of A produced for the study period are those of the Pittock sub-watersheds, both test and control. This may be accounted for in part by the fact that the

Pittock watershed has an extensive system of drain inlets, not found in the other watersheds. These inlets quickly intercept runoff and deliver it to the watershed outlets, thereby increasing the efficiency of delivery.

After Pittock, the Essex watershed exhibits the next highest values of A. The soils of Essex have a much greater clay content than those found at Kettle Creek. During runoff events, the smaller clay particles experience a low degree of deposition and subsequently a high proportion of the eroded clay soils are delivered to stream.

Values of A for the test sub-watersheds are greater than those of the corresponding controls for all three watersheds for every year of the study. In 1991, optimized A for both Pittock and Kettle Creek was only marginally higher for the test than for the control. Otherwise, test A values were significantly greater than those of the control, indicating higher delivery ratios in the test sub-watersheds.

In the Pittock watershed, the control sub-watershed has a much more consistent and even rate of flow at the outlet than the test sub-watershed. A combination of physical factors, including infiltration rates and holding capacity, is the underlying cause. The test sub-watershed base flow is not as consistent as the control and, also unlike the control, test outflow is characterized by sharp peaks during significant rainfall events. This indicates that runoff, and associated water born sediment, are delivered to the stream more rapidly in the test than in the control, likely resulting in higher delivery ratios.

The Kettle Creek control sub-watershed contains a wetland area where the rate of flow of surface runoff is significantly reduced and subsequent deposition of eroded materials occurs. Accordingly, the total amount of sediment delivered to the watershed outlet is significantly reduced and there is a corresponding decrease in delivery ratio.

The calibrated seasonal estimates of erosion and sediment delivery appear in Tables 4.15 to 4.17. As with longterm predictions, erosion tends to be greatest in the spring and summer for all three watersheds. The only notable exception occurs for 1990 in Essex test when estimated erosion for the winter season comprises 45 % of the annual total for the control sub-watershed. Unlike the longterm predictions, calibrated estimates of unit area sediment delivery show no clear trends except that the winter season tends to exhibit the highest delivery rates in both the Kettle Creek and Pittock paired watersheds. In Essex, spring generally experiences the greatest seasonal erosion during the dry years (1989 and 1991) but summer and fall accounted for the majority of the erosion during the wet year (1990).

Comparisons of calibrated estimates of unit area erosion and sediment delivery between test and control sub-watersheds also reveals consistent trends. In all three watersheds, the control sub-watershed consistently experiences more unit area erosion than the test sub-watershed, although the degree of difference varies between watersheds. Essex (Table 4.15) exhibits the smallest margin of difference. For spring and summer (contributing a majority of the erosion overall) Essex test unit area erosion is an average of 8.6 % and 7.7 % less, respectively, than that of the control. For Kettle Creek (Table 4.16), the corresponding average differences are 25.8 % less in the spring and 25.5 % less in the summer. In the Pittock watershed (Table 4.17), unit area erosion for the test is an average of 38.4 % less than that of the control during the spring and 32.2 % less during the summer.

Calibrated estimates of unit area sediment delivery, also presented in Tables 4.15 to 4.17, do not yield the same clear patterns as the estimates of unit area erosion. The only trends apparent are that the unit area sediment delivery tends to be higher in Kettle Creek test than Kettle Creek control for all seasons, delivery during winter in Pittock (the highest seasonal delivery) is greater in the control than in the test (25.9 % higher on average), and sediment delivery in Essex tends to be slightly greater (12.4 % on average) in the test during the spring (when delivery tends to be high in comparison to other seasons).

Phosphorus

Overland runoff has the capacity to transport eroded soil particles; the end result being the delivery of water borne sediment to the stream. Overland runoff can also carry and deliver chemical substances, both particulate and soluble forms, associated with the soil. The phosphorus version of GAMES (GAMESP) has the capacity to predict such overland transport and delivery of particulate and dissolved phosphorous by using a simplified simulation of the otherwise complex phosphorous transport process.

Estimates of watershed phosphorous outputs under longterm real conditions are presented in Table 4.10. The Essex paired watersheds have the higest values for unit area phosphorous delivery, averaging 3.39 kg/ha for the control and 3.32 for the test over the three years of the study. The next highest unit area phosphorus delivery rates are those for Pittock (0.39 kg/ha for control, 0.16 kg/ha for test) followed by the Kettle Creek watershed (0.74 kg/ha for control, 0.10 kg/ha for the test). These differences largely reflect differences in initial phosphorous content of surface soils in the three watersheds. In both Kettle Creek and Pittock, the test sub-watersheds clearly have lower phosphorous delivery than their control counterparts. In the Essex watershed, the unit area phosphorous delivery is initially higher for the test than for the control but the value for the test consistently decreases until lower than the control in 1991 (Table 4.10). All three test watersheds exhibit the same pattern of consistently decreasing phosphorous delivery while the controls either fluctuate (Kettle and Pittock) or exhibit a consistent increase (Essex). Since the soils of the paired sub-watersheds are very similar, differences between the test and control, with respect to estimated phosphorous delivery, should reflect to some degree differences in farm management practices.

The patterns shown by phosphorous delivery of the three watersheds are very similar to those patterns exhibited by estimates of sediment delivery under longterm real conditions. The only significant difference is the fact that phosphorous delivery values are higher for Pittock than for Kettle Creek while the reverse is true for sediment delivery. This similarity is based on the fact that the phosphorous delivery is based largely on the phosphorous associated with the eroded soil delivered as sediment. The differences in pattern between sediment and phosphorous are due to differences in the phosphorous content of the surface soils of the three watersheds.

The phosphorous enrichment ratios (PER) generated by the GAMESP model, also presented in Table 4.10, remain relatively constant throughout the study period and are within the expected range of 1.5 to 3.1 (Sharpley, 1980). Kettle Creek and Pittock exhibit similar PER's while Essex PER's are much lower. This simply means that, in Essex, the amount of P in the eroded soil is greater than that of the source soil by a smaller degree than in Kettle Creek and Pittock. This may be due to a narrower distribution of soil particle sizes in Essex compared to Kettle Creek and Pittock soils which contain more larger size fractions.

GAMESP longterm seasonal predictions of phosphorous delivery are presented in Tables 4.11 to 4.13. The trends observed for phosphorous delivery are mostly the same as those exhibited by longterm predictions of sediment delivery (Tables 4.7 to 4.9). In all watersheds, the control sub-watersheds experience greater rates of phosphorous delivery than their test counterparts for each season in each year of the study. Also, predicted phosphorous delivery, similar to sediment delivery, is highest during the spring of each year, accounting for more than 90 % of annual totals in Kettle Creek and Pittock.

One noted difference between phosphorus delivery and sediment delivery (Tables 4.7 to 4.9) is that phosphorus delivery is predicted to occur much more evenly over the year in Essex. Kettle Creek and Pittock are predicted to have phosphorus delivery highly specific to spring as with sediment.

5.0 MODEL APPLICATIONS

5.1 HSPF Applications

5.1.1 Modelling Schemes

HSPF user controlled input files were altered to reflect two extreme situations in farm management.

Firstly, a fallow condition was simulated for the entire test sub-watersheds as the worst possible case scenario. Secondly, a no till condition was simulated to reflect an aggressive conservation scheme (i.e. best case) throughout the test sub-watersheds.

The following HSPF input components relating to land areas were altered;

- interception storage (increased for fallow and decreased for no till);
- upper soil zone water storage capacity (increased for fallow and decreased for no till);
- Manning's n or surface roughness (increased for fallow and decreased for no till);
- soil delivery (increased for fallow and decreased for no till);
- gully erosion (increased for fallow and decreased for no till); and
- land cover (decreased for fallow and increased for no till).

The effect of these alterations to the input is to increase runoff from no till lands and decrease runoff from fallow lands due to alterations to surface soil water storage, surface roughness, and interception volume.

Soil loss is most significantly affected through the aforementioned changes in surface water runoff but more importantly through alterations to surface cover which directly affects sheet (i.e., interrill) erosion and through changes in soil delivery and gully (i.e. rill) erosion. In effect, the no till case reflects a more protected land surface with more resistance to runoff channelization and scouring due to the increased levels of surface organic matter. The fallow case reflects the opposite in this regard.

Phosphorus loss is not directly altered through model parameter changes but since phosphorus runoff is a function of water and soil movement a concomitant change is expected in phosphorus losses.

Results of model applications are discussed below.

5.1.2 Results and Discussion

5.1.2.1 Essex

Figures 5.1 to 5.6 display the results of model application runs in which no till (best case) and fallow (worst case) conditions were imposed for Essex test sub-watershed. Two- year cumulative plots show the difference between existing (1989 to 1990) conditions and the two management options. The period of application includes both dry and wet conditions. Table 5.1 summarizes the effects of land management for all sub-watersheds.

The model predicts a minor increase in runoff (i.e. 5.4%) from no till and reduced runoff (i.e. 19%) from fallow. Differences in surface roughness, depressional storage and soil water holding capacity account for the predicted range.

Soil loss behaviour under the two management schemes tested is predicted to be dramatically different. A no-till system is predicted to result in a 62% savings in soil loss while a fallow condition would increase soil loss by 87%. The predicted additional soil loss from a continuous fallow condition occurred largely during the early summer of 1989, later February 1990 and September to October of 1990. At these times, the cover provided by plant residue is most effective in arresting soil loss.

Predicted phosphorus runoff losses under no till are about 60% lower than under existing 1989 to 1990 conditions. The fallow condition is predicted to result in 39% more phosphorus and loss. Increased phosphorus loss under fallow conditions is proportionally less than soil loss since a large portion of annual total phosphorus losses are in soluble and non-soil attached forms. These are not directly affected by land management practises in these simulations although soluble phosphorus is predicted to be affected indirectly as total runoff is affected.

5.1.2.2 Kettle Creek

Figures 5.7 to 5.12 display the results of model applications to no till and fallow conditions in cumulative terms over a two-year period. This two-year period includes a wide variety of conditions including dry weather in 1989 and much wetter conditions in 1990.

The model predicts a minor increase in runoff (i.e. 3.6%) from no till and reduced fallow runoff (i.e. 7.3%), as expected. This is consistent with observations made elsewhere.

Soil loss and transport predictions vary considerably more from the existing case. The no till case as predicted to reduce soil loss by 25% and the fallow case increased soil loss by about 69%. The effects of the scenarios was felt particularly during a few runoff events. In the no till case, a single event in February 1990 accounted for most of the difference. In the fallow case an event in August 1990 accounted for most of the difference. These results highlight the need to monitor runoff and erosion in the long term since single rare significant events can result in soil losses which exceed losses suffered over entire years.

5.1.2.3 Pittock

Figures 5.13 to 5.18 display model input results from the two application scenarios discussed earlier. The dry and wet conditions of 1989 and 1990, respectively, result in dissimilar runoff rates and predicted manageability of the runoff in those two years. Table 5.1 summarizes the two year benefit of no till and the disbenefit of fallow for Pittock test sub-watershed.

No till runoff is predicted to be slightly raised (i.e. +11%) from the existing case as in Essex and Kettle Creek for the same reasons, that is, differences in surface roughness, depression storage and soil water holding capacity. The fallow case is predicted to be very similar to the existing case.

Soil loss changes are less than those predicted for Essex and Kettle Creek. Nevertheless, predicted changes are still significant at 29% savings for no till and a 46% increase for fallow. The periods wherein significant differences are expected in terms of soil loss are March to April 1989, February 1990, and December 1990. These winter periods were characterized by low snow cover and occasional mild rainfall events. Residue and cover levels on the fields differ the most at these times. Pittock was shown in Report #6, Water Quality, to be the least erosive and problematic of the three PWS study areas. It is therefore not surprising that soil loss manageability would also be lower at this site with fewer problem areas.

Predicted phosphorus changes under no till (i.e. 27%) and fallow (i.e. 66%) conditions are less than corresponding soil loss affects as expected. However, the predicted phosphorus losses for the two year period range by a factor of 1.67 from no till to fallow conditions.

Predicted phosphorus losses for the two land management scenarios are similar in relative impact to the soil loss scenarios with about 66% more phosphorus loss in the fallow case and about 27% phosphorus savings in the no till case. Clearly, the soil attached phosphorus accounted for a large portion of total phosphorus loss and therefore phosphorus movement minimizes soil loss.

5.2 GAMES Applications

5.2.1 Fallow Conditions

Uncalibrated runs of the GAMES model to simulate complete fallow conditions have been completed for the test and the control sub-watersheds for the years 1989, 1990, and 1991. Simulation of fallow conditions is achieved by modifying the Crop Code, C-Factor and

Manning's n for each polygon in the input files. All fallow results have also been generated after calibration to the observed mouth loads in the respective years.

Examination of the paired sub-watersheds under a worst case scenario (i.e. continuous fallow conditions) reveals inherent differences in susceptibility to erosion between the controls and the corresponding test sub-watersheds (Table 5.2). In the Essex watershed, the control sub-watershed exhibits a lower average erosion rate (8.2 tonnes/hectare) than the test sub-watershed (8.7 tonnes/hectare). However, the control also exhibits a higher average sediment delivery rate and sediment delivery ratio (5.37 tonnes/hectare, 65.5% respectively) in comparison to the test sub-watershed (4.87 tonnes/hectare, 55.9% respectively). In the Kettle Creek and Pittock watersheds, the test sub-watersheds exhibit lower erosion rates (32.6 and 18.2 tonnes/hectare, respectively) than the control sub-watersheds (39.6 and 28.1 tonnes/hectare, respectively). Kettle and Pittock average sediment delivery rates are also lower for the test than for the control. However, the sediment delivery ratios are higher in the test sub-watersheds than in the control.

Considering both total gross erosion and average erosion rates, and based only on GAMES model inputs without calibration, the Kettle Creek watershed exhibits the highest susceptibility to soil erosion followed by Pittock and than the Essex watershed.
Within the three watersheds, the control sub-watersheds appear more susceptible to erosion at both Kettle Creek and Pittock while the test sub-watershed seems more prone to erosion at Essex.

The **calibrated** GAMES predictions for complete fallow conditions in the SWEEP watersheds are given in Table 5.3. As with the longterm predictions, the Essex control sub-watershed exhibits slightly lower unit area erosion rates than the test sub-watershed in all three years of the study. Unlike the longterm estimates, the unit area sediment delivery values for the control are also slightly lower than those of the test sub-watershed for all three years of concern, although the calculated delivery ratio remains higher for the control sub-watershed. This indicates that some factor outside of those parameters incorporated into the model acts to render the test sub-watershed inherently more susceptible to erosion than the control.

In both the Kettle Creek and Pittock watersheds, the test sub-watersheds exhibit significantly lower unit area erosion than the control counterparts (Table 5.3), just as predicted by the longterm general GAMES runs. While unit area sediment delivery is also generally lower for the Pittock test sub-watershed, the test sub-watershed at Kettle Creek has a higher unit area sediment delivery value than the control for all three years of concern. This indicates that while the Pittock test sub-watershed is slightly less prone to erosion and subsequent sediment delivery than the control, the opposite is true for Kettle Creek. Here, a significantly greater proportion of the eroded sediment is delivered to stream from the test than from the control sub-watershed. The most reasonable explanation for this situation is the presence of a large flat wetland area in the Kettle Creek control sub-watershed that acts as a depositional area and reduces sediment delivery.

5.2.2 Best Case Conditions

The GAMES model may also be run to simulate conditions that would occur under complete no-till agricultural practices in a given watershed. This "best-case" scenario is accomplished by modifying the C-factor and Mannings n (surface roughness) components of the input file. Each specific crop type has specific C and n values for different tillage systems, including no-till.

The results of longterm general GAMES model best-case runs are presented in Table 5.4. Since all fields are assumed to be no-till, differences between watersheds reflect inherent differences in physical characteristics (soil types, slopes, natural drainage patterns) and to a much lesser extent, differences in crop type.

The unit area rates of erosion for the best-case scenario follow the same pattern as the longterm real conditions GAMES model predictions (Table 4.6). The highest rates of unit area erosion are seen in the Kettle Creek watershed followed by Pittock and then Essex. However, the best-case erosion rates are approximately only one fourth of those predicted for real conditions.

The GAMES predictions for the best case scenario after calibration to observed loads are given in Table 5.5. The general pattern of erosion and delivery values is the same as those predicted for the longterm best-case scenario. The Kettle Creek watershed exhibits the highest unit area erosion followed by Pittock and then Essex. Within watersheds, Essex test unit area erosion and sediment delivery are consistently higher, although only slightly, than those of the control. The Pittock test sub-watershed exhibits unit area erosion and sediment delivery that are consistently lower than predicted for the control. In Kettle Creek, the unit area erosion is consistently higher for the control than for the test sub-watershed. Unit area sediment delivery is slightly higher in the test for 1989 and 1991 but is significantly higher for 1990. Records reveal that a larger than normal proportion of fields were planted to soy beans and corn in the Kettle test sub-watershed that year. These crops, even under no-till management, leave the land more exposed and prone to erosion than other crops such as grains or hay. This would be even more pronounced in a year with heavy rainfall such as 1990.

Overall, erosion predicted for best-case conditions is still only about one fourth of that predicted by the GAMES model run to simulate real conditions after calibration.

A brief comparison of calibrated GAMES predictions under all three scenarios (best-case, real conditions, and worst-case) serves to delineate any gains in erosion reduction resulting from conservation farming practices in the test sub-watersheds. Tables 5.6 to 5.8 provide the calibrated GAMES predictions for such a comparison.

The most obvious trends seen in these tables are that erosion and sediment delivery for real conditions are closer to corresponding values from the best-case scenario than those from the worst-case (all fallow) scenario, and the relatively heavy precipitation of 1990 results in the highest erosion and sediment delivery in all watersheds under all three scenarios.

In the Essex watershed, estimated unit area erosion and sediment delivery are higher for the test than for the control for both the best-case and worst-case scenarios. However, under real conditions, test unit area erosion is actually slightly lower than that of the control in all three years. At the same time, the difference between unit area sediment delivery of the test and the control sub-watersheds decreases for each successive year until 1991 when the test becomes lower than the control. This suggests that while Essex test is inherently more prone to erosion, the land management practices that have been utilized as part of the SWEEP PWS have improved its performance with respect to erosion to a point where it is better than the control sub-watershed.

In the Kettle Creek watershed, all three scenarios generate unit area erosion that is consistently lower in the test sub-watershed and unit area sediment delivery that is consistently higher in the test than in the control sub-watershed (Table 5.7). This illustrates that control delivery rates are lower than expected probably due to the presence of a wetland acting as a depositional area in the control sub-watershed. Further examination also reveals that the performance indicated by real conditions output, compared to best and worst case scenario output, remains relatively constant in the control sub-watershed. However, the same relative performance shows a consistent improvement over time for the test sub-watershed. For the control, unit area erosion for real conditions is greater than best-case unit area erosion by a factor of 3.1 in 1989, 4.1 in 1990 and 4.1 in 1991. The same comparative factors for the test sub-watershed are 4.1 for 1989, 3.6 for 1990, and 2.8 for 1991, a consistent decrease. This represents an improvement towards the best-case scenario over the period of study.

The Pittock test sub-watershed exhibits real condition erosion and sediment delivery values that are lower than those of the control, both in a direct comparison and when considered relative to corresponding best-case and worst-case values (Table 5.8). Unit area erosion predicted by GAMES for real conditions is greater than best-case equivalents in the control by a factor of 5.1 in 1989 and 4.4 in both 1990 and 1991. The same comparative factors for the test sub-watershed are 4.2 for 1989, 3.5 for 1990 and 4.2 for 1991. The test is consistently closer to best-case erosion than is the control.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based upon the modelling activities undertaken, various conclusions have been drawn. These are listed below under select categories.

A. Model Utility and Relevance to Watershed Assessment

- GAMES is an effective screening level soil and phosphorus management tool which is relevant to the Southwestern Ontario landscape. GAMES provides site specific and seasonal erosion and transport estimates which are particularly useful for farm planning and remediation program development. In this study, GAMES served to aid in farm level management and education in a modified form. The use of modified GAMES as a farm level management tool is described in Report #2. Also, GAMES and GAMESP provide fast screening level estimates of benefit, soil and phosphorus control, that could be achieved in the study sub-watersheds (Report #1) at the watershed selection stage.

  GAMESP has been documented in this report in an application involving estimates of the long term sensitivity and manageability of the study sub-watersheds and fields to various levels of conservation management. The model has had diverse applications in the PWS and it has been found to be useful, easy to use and interpret, capable of operating with typically available information, and relevant to Southern Ontario.

- HSPF is a different type of model with much different capabilities and functions. HSPF is foremost, a hydrological model. HSPF is conceptually a deterministic model, attempting to account for all material storage components and flux and reaction pathways in a dynamic manner. While GAMES and GAMESP are best suited to estimating long term average conditions of soil and phosphorus loss and transport, HSPF is suited to predicting short term event and baseflow conditions on a real time series basis. Also, since HSPF builds the capabilities of predicting material movement on top of the hydrological components of the watershed; material transport, overland and instream, are also modelled in a dynamic manner. Both models can utilize the same polygon structure for the spatial representation of the same watershed. HSPF also includes detailed drainage system hydraulic data. Because of the ambitious nature of this model, it requires a large database to operate. In the PWS the information was available through intensive and continuous monitoring of soils, crops, flow, and water quality, and meterological conditions. In fact, HSPFs accuracy and capabilities are enhanced by detailed site specific information because it attempts to describe that same site specific behaviour.

In the PWS HSPF served to identify real benefits of conservation farming systems in the short and long term and assist in understanding the mechanisms through which benefits were realized. In this capacity, HSPF was an assessment tool whereas GAMESP was more useful as a planning tool. HSPF has the capability to address a wide variety of land and instream measures to affect soil and phosphorus control, some of which are demonstrated here. It can also be useful in evaluating the impacts of extreme storm events at any time through an annual period in terms of runoff water quality, the impact on flow conveyance systems, soil loss and others.

The environmental focus of HSPF makes it useful as a water quality and streamflow assessment tool. This study investigated runoff as daily flows and loads and the effect of storms was accurately predicted in terms of three or four orders of magnitude increases and decreases within hours and days. Climate change scenarios can be investigated using HSPF by adjusting meterological input and conducting long term simulations.

B. Conservation System Benefits

Assessment of observed environmental behaviour and benefits are discussed in report #5, and #6. Those reports quantify changes and trends resulting from the implementation program. It was clearly shown in those reports that the trend to improvement was in effect but that more time (i.e., 3 to 5 years) was required beyond a transition phase before the full benefits would be quantified. The model assessments using GAMES, GAMESP and HSPF were conducted assuming that the scenarios tested had been in place sufficiently long to establish a new equilibrium in the soil. These hypothetical cases represent the best estimates of benefit or impact of related measures.

However, the relevance of the predicted hypothetical cases is largely dependant upon the adjustments made to a variety of model parameters in HSPF, GAMES and GAMESP. There is very little site specific guidance in this regard and so, at present, modellers are forced to use reasonable judgement and be guided by research conducted elsewhere or in Ontario under different conditions.

GAMESP predicts extremely high benefits from conservation tillage systems, that is the so called best case (no till) scenario. And similarly large disbenefit from the continuous fallow (i.e., worst) case.

In all sub-watersheds the worst case represents a larger departure from the existing case than the best case in terms of gross erosion. Also, the largest benefits of the best case scenario are predicted to occur in 1990, the wet year.

When predicted sediment delivery is examined the range grows wider between worst and best case so that the worst case scenario delivers up to 100 times more sediment to the stream than the best case over the three year period. In this regard, Pittock displays the most difference between worst and best cases and Kettle Creek and Essex are similar.

Instinctively these predictions seem excessively optimistic in the best case and pessimistic in the worst case.

HSPF predicts that best and worst case conditions of soil loss may differ by a factor of 2 to 5 over the two year period 1989-90. This compares to a range of 30 to 100 times predicted by GAMESP. Once again, if instinct is of any value, the HSPF predictions seem more reasonable. Also, since HSPF can account for the affects of land management upon flow it more accurately describes the complex relationship between land management and soil movement.

Regardless of differences, both models predict that significant environmental benefits can be realized by adopting conservation farm systems.

6.2 Recommendations

The following recommendations are presented based upon the modelling efforts undertaken in the PWS.

- Screening level models such as GAMESP are useful planning and communication aids and should become an integral part of the conservation implementation process. This is particularly true in today's information based society since model results are often unconditionally accepted by non-experts. While this has its disadvantages, models can also be effective communication tools since a land owners or resource managers can gain an appreciation for the benefits that can accrue from positive action in interactive planning-modelling sessions.

- Detailed deterministic models such as HSPF are useful evaluation tools which after calibration can provide much more accurate assessments of potential benefit as well as providing information on the mechanism of benefit. That is, this type of model can help the user to understand how the land management action affects the hydrological cycle and thus how it affects soil and phosphorus loss. HSPF is also useful in predicting the impact of simple extreme events and very long term trends such as climate change. HSPF is useful to program managers at the design and evaluation stages but is not practical as an educational tool at the farm level.

- Land management models should continue to be applied to planning, communication and evaluation. However, there is a significant shortfall in the body of evidence regarding the effects of various land management practices upon common field and watershed parameters. At present the modeller must rely heavily upon estimation and experience and therefore projections to different conditions is fraught with uncertainty. Future research should be directed towards quantifying the affect of land management upon several key model parameters, common to GAMES, GAMESP and HSPF such as surface roughness, infiltration, and soil erodibility. Currently, the models are sufficiently descriptive and accurate to provide the necessary level of guidance to managers, however the ability to manipulate a model input to reflect various practices is currently limited to highly experienced scientists. A goal of model development should be to make the process more readily useable by less experienced model users.

- The PWS or similar study should be continued for several more years so that changes caused by conservation system adoption can became fully integrated at the watershed scale. The models used in this study predict benefits that can potentially be achieved in the long term. They cannot accurately accommodate transient conditions as observed in the PWS. Furthermore, the PWS did not allow for the identification of the adjustments to model factors resulting from land management systems since these systems were not in place for a sufficient period of time. Ideally pilot watersheds should be permanently monitored in different regions of the province so that continual improvement can be made in model set up, calibration, and adjustment.

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Table 2.1: Number of Polygons used in GAMES, 1989 to 1990

Watershed	Year	Number of Polygons*	Number of Pseudocells
Essex Control	1989	74	31
Essex Control	1990	79	31
Essex Control	1991	78	31
Essex Test	1989	145	56
Essex Test	1990	132	56
Essex Test	1991	139	56
Kettle Creek Control	1989	348	82
Kettle Creek Control	1990	354	82
Kettle Creek Control	1991	361	82
Kettle Creek Test	1989	451	186
Kettle Creek Test	1990	459	186
Kettle Creek Test	1991	482	186
Pittock Control	1989	282	73
Pittock Control	1990	284	73
Pittock Control	1991	296	73
Pittock Test	1989	275	73
Pittock Test	1990	301	73
Pittock Test	1991	307	73

* - polygon total includes pseudocells

TABLE 2.2: DRAINAGE SYSTEM CHARACTERISTICS USED IN HSPF

Simulation Component	Characteristics
Hydraulics	• Length • Slope • Surface Roughness • Depth/Volume/Surface Area/Flow Rate Relationship
Sediment Transport	• Sediment Bed Width • Sediment Bed Porosity • Sediment Bed Depth • Sediment Bed Compositions as sand, silt and clay • Average particle sizes, settling rate, density, erodibility, and threshold shear stresses for settling and scour for sand, silt and clay.
Phosphorus	• Treated as a biochemically conservative material and so no additional characteristics required.

TABLE 3.1: TIME SERIES INPUT/OUTPUT USED IN HSPF

Data Type	Parameter	Time Step
Input		
Meteorology	Precipitation	15 minutes
	Air Temperature	Hourly
	Wind Speed	Hourly
	Solar Radiation	Hourly
	Evaporation	Daily
	Dew Point Temperature	Daily
Streamflow	Observed Streamflow at Key Sites	Hourly
Water Quality	Suspended Solids at Key Sites	Daily Loads
	Phosphorus at Key Sites	Daily Loads
Output		
Streamflow	Predicted Streamflow at Key Sites	Hourly
	Total Runoff from each PLS	Daily
Water Quality	Predicted Suspended Solids Levels at Key Sites	Daily
	Total Erosion Loss from each PLS	Daily
	Predicted Phosphorus Loads at Key Sites	Daily
	Total Phosphorus Loss from each PLS	Daily
	Net Deposition or Scour from Key Reaches	Daily
	Intermediate Processes	As required
	Variables and State Variables to Aid in Model Calibration	As required

Table 4.1   Typical HSPF Tabular Output

```
ERVIOUS LAND SEGMENT NO. 116                          1 %-HNYWD-CONV W/GR                                 REPORT FOR MONTH 1989/ 1

** SEDMNT ***

 STATE VARIABLES                          STORAGE
                                             DETS               COVER
                                        TONNES/HA            FRACTION
   SEGMENT-WIDE                         1.052E-04           0.851

 FLUXES                                   WASHOFF               SCOUR     TOTAL             VERTICAL ADDITIONS
                                             WSSD               SCRSD     SOSED                  DET      NVSI
                                        TONNES/HA           TONNES/HA TONNES/HA           TONNES/HA TONNES/HA
   SEGMENT-WIDE                         3.050E-04           3.298E-05 3.380E-04           2.530E-03    0.

** PHOS ***

 SEGMENT WIDE VALUES
 STATE VARIABLES    (KG/HA)                                                                      LAYER DERIVED

   STORAGES BY LAYERS         ORGANIC P           PO4-P ADS PO4-P SOL                                  PLANT P              TOTALS

     SURFACE LAYER               83.980             133.991     0.001                                    0.200             218.173
     UPPER PRINCIPAL            249.250             494.654     0.042                                    4.000             747.946
     UPPER TRANSITORY(INTER)                                    0.004                                                        0.004
     LOWER LAYER                306.000            3499.859     0.186                                    5.000            3811.046
     ACTIVE GROUNDWATER           0.612               6.981     0.004                                    0.000               7.597

     TOTALS                     639.842            4135.486     0.237                                    9.200            4784.765

 FLUXES             (KG/HA)
   FLOWS OF P IN SOLUTION    <--SURFACE LAYER---><-UPPER LAYER PRIN-> INTERFLOW           <---LOWER LAYER---->         GROUNDWATER
                                OUTFLOW      PERC      PERC  TO TRANS   OUTFLOW                 PERC DEEP PERC             OUTFLOW
     PO4-P IN SOLUTION        1.970E-03 2.551E-02 5.363E-02 2.516E-02 2.159E-02           9.776E-03 5.146E-04           2.492E-02

   OTHER OUTFLOWS              SEDIMENT ASSOCIATED OUTFLOWS           <--TOTAL OUTFLOW--->
                              ORGANIC P PO4-P ADS     TOTAL               PO4-P  PHOSPHOR
                                  SDORP     SDP4A    SOSEDP               POPO4    POPHOS
                              0.000E+00 0.000E+00 0.000E+00           4.848E-02 4.848E-02

PO4 IMMOBILIZATION BY LAYER               SURFACE          UPPER PRIN                LOWER           ACTIVE GW               TOTAL
                                           SP4IMB              UP4IMB               LP4IMB              AP4IMB              TP4IMB
                                        7.886E-06           5.268E-04            0.000E+00           0.000E+00           5.347E-04

RGP MINERALIZATION BY LAYER               SURFACE          UPPER PRIN                LOWER           ACTIVE GW               TOTAL
                                           SORPMN              UORPMN               LORPMN              AORPMN              TORPMN
                                        0.000E+00           0.000E+00            0.000E+00           0.000E+00           0.000E+00

 BALANCE                      (KG/HA) IN (KG/HA)
                              2.118E-03 4.785E+03

EACH/MIXED-RESERVOIR NO.  11                          LOWER GORING DRAIN                                  REPORT FOR MONTH 1989/ 1

** CONS ***

 CONSERVATIVE NO.  1                  PHOSPHORUS

 STATE VARIABLE
   CONCENTRATION (    UG/L)     193.61

 FLUXES  (      KG)               TOTAL     TOTAL
                                 INFLOW   OUTFLOW
                                   ICON     ROCON
                              1.693E+01 1.692E+01

 BALANCE                             KG IN      KG
                              9.313E-07 1.693E+01

** SEDTRN ***

 STATE VARIABLES
                                              SAND      SILT      CLAY     TOTAL
   CONC. IN SUSPENSION (MG/L)                 0.71      0.00      0.16      0.86

   STORAGES (TONNES)                          SAND      SILT      CLAY     TOTAL
            SUSPENSION                   5.803E-05 8.080E-12 1.271E-05 7.073E-05
            BED                          5.477E+00 1.096E+01 1.096E+01 2.740E+01
            TOTAL                        5.477E+00 1.096E+01 1.096E+01 2.740E+01

   BED DEPTH (M)                              0.05

 FLUXES (TONNES)                              SAND      SILT      CLAY     TOTAL

   TOTAL INFLOWS                         5.461E-02 2.055E-02 9.691E-02 1.721E-01
   DEPOSITION/SCOUR                     -4.485E-03-2.107E-04-2.768E-03-7.464E-03
   TOTAL OUTFLOWS                        5.904E-02 2.077E-02 9.969E-02 1.795E-01

 BALANCE                          TONNES IN  TONNES   FOR SAND, SILT, CLAY
                               5.364E-07 5.536E+00
                              -2.576E-06 1.098E+01
                              -3.472E-06 1.106E+01
```

TABLE 4.2: HSPF INPUT PARAMETERS DETERMINED IN ESSEX SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Water Budget for Pervious Areas	INFILT	mm/hr	Soil Infiltration Capacity	.008-0.8^1	0.03-2.6
	AGWRC	day^{-1}	Groundwater Recession Rate	0.18-0.95^1	0.38-0.91
	IRC	day^{-1}	Interflow Recession Rate	0.2-0.6^2	0.1-0.8
	LZSN	mm	Lower Soil Zone Water Holding Capacity	25^2	25-63
	UZSN	mm	Upper Soil Zone Water Holding Capacity	2-3.5^3	3-6
	INTERCEP	mm	Interception Storage	0-2^4	1-4
	NSUR	dimensionless	Manning's Roughness Coefficient for Overland Runoff	0.05-0.15^5	0.05-0.25
	LZET	none	Lower Zone Evapotransportation Parameter	0.05-0.10^4	0.20-0.70
Soil Loss from Pervious Areas	KRER	complex	Soil Detachment Equation Coefficient	0.40-0.49^6	0.40-0.49
	JRER	complex	Soil Detachment Equation Exponent	2.5	2.5
	KSER	complex	Sediment Washoff Equation Coefficient	0.13-0.25^7	0.13-0.25
	JSER	complex	Equation Coefficient Sediment Washoff	1.7	1.7
	KGER	complex	Equation Exponent Soil Matric Scour Equation Coefficient	0.002-0.005^7	0.002-0.005
	JGER	complex	Soil Matrix Scour Equation Exponent	0.50	0.50

TABLE 4.2: HSPF INPUT PARAMETERS DETERMINED IN ESSEX SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Phosphorus Loss from Pervious Areas	XFIX	μg/g	Freundlich Isotherm Foxed Phosphorus for all soil layers	440-920[8]	440-920
	KI	none	Freundlich Isotherm Coefficient	15	15
	NI	none	Freundlich Isotherm Exponent	1.5	1.5

Notes:

[1] Dependant upon air temperature and antecedent conditions.
[2] Dependant upon baseflow and groundwater reserve.
[3] Dependant upon landuse, tillage practise, and groundwater resource.
[4] Dependant upon vegetative covers.
[5] Dependant upon land use, tillage practise, and vegetative cover.
[6] Dependant upon soil type.
[7] Dependant upon tillage methods.
[8] Dependant upon layers (surface, upper, lower and groundwater layers).

TABLE 4.3: HSPF INPUT PARAMETERS DETERMINED IN KETTLE CREEK SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Water Budget for Pervious Areas	INFILT	mm/hr	Soil Infiltration Capacity	.003-0.3[1]	0.05-2.2
	AGWRC	day^{-1}	Groundwater Recession Rate	0.35-0.48[1]	0.63-0.86
	IRC	day^{-1}	Interflow Recession Rate	0.2-0.6[2]	0.1-0.8
	LZSN	mm	Lower Soil Zone Water Holding Capacity	75-125[2]	63-213
	UZSN	mm	Upper Soil Zone Water Holding Capacity	2[3]	7-12
	INTERCEP	mm	Interception Storage	0-2[4]	1.5-4
	NSUR	dimensionless	Manning's Roughness Coefficient for Overland Runoff	0.04-0.20[5]	0.05-0.25
	LZET	none	Lower Zone Evapotransportation Parameter	0.05-0.10[4]	0.20-0.70
Soil Loss from Pervious Areas	KRER	complex	Soil Detachment Equation Coefficient	0.39-0.50[6]	0.39-0.50
	JRER	complex	Soil Detachment Equation Exponent	2.7	2.7
	KSER	complex	Sediment Washoff Equation Coefficient	2.5-4.0	2.5-4.0
	JSER	complex	Equation Coefficient Sediment Washoff	2.3	2.3
	KGER	complex	Equation Exponent Soil Matric Scour Equation Coefficient	0.02-0.06[7]	0.02-0.06
	JGER	complex	Soil Matrix Scour Equation Exponent	1.6	1.6

TABLE 4.3: HSPF INPUT PARAMETERS DETERMINED IN KETTLE CREEK SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Phosphorus Loss from Pervious Areas	XFIX	$\mu g/g$	Freundlich Isotherm Foxed Phosphorus for all soil layers	440-1700[8]	440-1700
	KI	none	Freundlich Isotherm Coefficient	15	15
	NI	none	Freundlich Isotherm Exponent	1.5	1.5

Notes:

[1] Dependant upon air temperature and antecedent conditions.
[2] Dependant upon baseflow and groundwater reserve.
[3] Dependant upon landuse, tillage practise, and groundwater resource.
[4] Dependant upon vegetative covers.
[5] Dependant upon land use, tillage practise, and vegetative cover.
[6] Dependant upon soil type.
[7] Dependant upon tillage methods.
[8] Dependant upon layers (surface, upper, lower and groundwater layers).

TABLE 4.4: HSPF INPUT PARAMETERS DETERMINED IN PITTOCK SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Water Budget for Pervious Areas	INFILT	mm/hr	Soil Infiltration Capacity	0.001-0.030[1]	.010-0.10
	AGWRC	day^{-1}	Groundwater Recession Rate	0.50-0.94[1]	0.48-0.91
	IRC	day^{-1}	Interflow Recession Rate	0.5-0.6[2]	0.6-0.9
	LZSN	mm	Lower Soil Zone Water Holding Capacity	100-150[2]	150-250
	UZSN	mm	Upper Soil Zone Water Holding Capacity	2[3]	7-12
	INTERCEP	mm	Interception Storage	0-2[4]	1-5
	NSUR	dimensionless	Manning's Roughness Coefficient for Overland Runoff	0.05-0.20[5]	0.05-0.25
	LZET	none	Lower Zone Evapotransportation Parameter	0.05-0.10[4]	0.20-0.70
Soil Loss from Pervious Areas	KRER	complex	Soil Detachment Equation Coefficient	0.39-0.50[6]	0.39-0.50
	JRER	complex	Soil Detachment Equation Exponent	2.2	2.2
	KSER	complex	Sediment Washoff Equation Coefficient	3.0-5.0	3.0-5.0
	JSER	complex	Equation Coefficient Sediment Washoff	2.7	2.7
	KGER	complex	Equation Exponent Soil Matric Scour Equation Coefficient	0.15-0.25[7]	0.15-0.25
	JGER	complex	Soil Matrix Scour Equation Exponent	1.5	1.5

TABLE 4.4: HSPF INPUT PARAMETERS DETERMINED IN PITTOCK SUB-WATERSHEDS CALIBRATION

Model Compartment	Parameter	Units	Meaning	Range of Values	
				Winter	Summer
Phosphorus Loss from Pervious Areas	XFIX	μg/g	Freundlich Isotherm Foxed Phosphorus for all soil layers	438-2200[8]	438-2200
	KI	none	Freundlich Isotherm Coefficient	15	15
	NI	none	Freundlich Isotherm Exponent	1.5	1.5

Notes:

[1] Dependant upon air temperature and antecedent conditions.
[2] Dependant upon baseflow and groundwater reserve.
[3] Dependant upon landuse, tillage practise, and groundwater resource.
[4] Dependant upon vegetative covers.
[5] Dependant upon land use, tillage practise, and vegetative cover.
[6] Dependant upon soil type.
[7] Dependant upon tillage methods.
[8] Dependant upon layers (surface, upper, lower and groundwater layers).

Table 4.5: GAMES Sensitivity Analysis Output

Watershed	Year	R Value	Total Gross Erosion (Tonnes)	Average Erosion (Tonnes/ha)	Sediment Delivery (Tonnes)	Phosphorous Delivery (kg)
Kettle Test	1990	63.3	2780.0	6.7	71.9	12.0
Kettle Test	1990	95.0	5142.8	12.5	896.6	150.3
Kettle Test	1990	126.7	5564.4	13.5	1158.0	209.6

Table 4.6: GAMES Sediment and Runoff Summary: 1989 to 1991
Real Conditions

		Sub-watershed	Essex Control	Essex Test	Kettle Control	Kettle Test	Pittock Control	Pittock Test
Total		1989	999.6	1530.8	4297.5	4243.3	2887.3	1887.0
Gross	(tonnes)	1990	977.9	1495.0	4792.3	4172.2	2971.5	1722.2
Erosion		1991	994.7	1410.2	4902.0	3356.1	2974.8	1819.7
Average		1989	3.55	3.52	12.16	10.34	7.53	5.26
Erosion	(tonnes/ha)	1990	3.48	3.43	13.56	10.17	7.75	4.80
		1991	3.54	3.24	13.87	8.18	7.76	5.07
Total		1989	258.0	297.7	228.8	314.0	79.7	38.9
Sediment		1990	304.9	268.7	238.4	225.3	71.2	44.4
To Stream	(tonnes)	1991	345.0	316.0	247.9	204.8	77.5	47.8
Average		1989	0.92	0.68	0.65	0.77	0.21	0.11
Sediment		1990	1.08	0.62	0.67	0.55	0.19	0.12
To Stream	(tonnes/ha)	1991	1.23	0.73	0.70	0.50	0.20	0.13
Delivery		1989	25.81	19.45	5.32	7.40	2.76	2.06
Ratio	(%)	1990	31.18	17.97	4.97	5.40	2.40	2.58
		1991	34.68	22.41	5.06	5.10	2.61	2.63

Table 4.7: GAMES Longterm Seasonal Erosion Predictions; Essex

		Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)	
Year	Season	Control	Test	Control	Test	Control	Test	Control	Test
1989	Spring	311.1	416.1	1.106	0.961	269.9	289.9	0.960	0.670
	Summer	237.9	334.8	0.846	0.774	3.7	4.0	0.013	0.009
	Fall	134.6	159.5	0.479	0.369	1.3	1.0	0.005	0.002
	Winter	115.1	170.8	0.409	0.395	1.1	1.1	0.004	0.003
1990	Spring	287.4	387.3	1.022	0.895	234.5	256.6	0.834	0.593
	Summer	232.1	330.7	0.825	0.764	4.1	3.5	0.015	0.008
	Fall	115.2	165.4	0.410	0.382	1.1	0.8	0.004	0.002
	Winter	103.4	157.1	0.368	0.363	1.0	0.9	0.004	0.002
1991	Spring	302.4	431.4	1.075	0.997	250.9	294.8	0.892	0.681
	Summer	229.7	329.9	0.817	0.762	4.5	4.1	0.016	0.009
	Fall	107.1	157.8	0.381	0.365	0.9	0.9	0.003	0.002
	Winter	99.7	147.2	0.355	0.340	0.9	0.8	0.003	0.002

Table 4.8: GAMES Longterm Seasonal Erosion Predictions; Kettle Creek

Year	Season	Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)	
		Control	Test	Control	Test	Control	Test	Control	Test
1989	Spring	1819.2	1841.6	5.146	4.494	1162.4	1195.1	3.288	2.916
	Summer	2067.8	1947.0	5.850	4.751	59.4	72.5	0.168	0.177
	Fall	654.1	602.0	1.850	1.469	9.5	14.4	0.027	0.035
	Winter	612.5	513.9	1.733	1.254	11.8	12.5	0.033	0.031
1990	Spring	1810.5	1686.0	5.122	4.114	959.1	952.8	2.713	2.325
	Summer	2228.5	2019.1	6.304	4.927	45.6	55.1	0.129	0.134
	Fall	742.1	616.7	2.099	1.505	13.5	12.4	0.038	0.030
	Winter	473.4	502.8	1.339	1.227	7.5	14.7	0.021	0.036
1991	Spring	2221.6	1417.8	6.285	3.460	1275.8	828.8	3.609	2.022
	Summer	2336.5	1736.3	6.610	4.237	70.2	51.8	0.199	0.126
	Fall	718.2	523.3	2.032	1.277	12.0	10.8	0.034	0.026
	Winter	553.3	455.4	1.565	1.111	9.2	7.1	0.026	0.017

Table 4.9: GAMES Longterm Seasonal Predictions; Pittock

		Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)	
Year	Season	Test	Control	Test	Control	Test	Control	Test	Control
1989	Spring	1121.1	655.3	2.924	1.841	352.2	197.7	0.919	0.555
	Summer	1095.0	689.3	2.856	1.937	6.5	2.6	0.017	0.007
	Fall	329.9	221.1	0.860	0.621	0.7	0.6	0.002	0.002
	Winter	294.0	188.5	0.767	0.530	0.9	0.5	0.002	0.001
1990	Spring	784.6	590.4	2.046	1.659	193.8	201.9	0.505	0.567
	Summer	829.4	708.5	2.163	1.991	2.9	3.3	0.008	0.009
	Fall	326.1	193.8	0.851	0.545	0.8	0.6	0.002	0.002
	Winter	258.8	162.4	0.675	0.456	0.6	0.4	0.002	0.001
1991	Spring	729.4	609.7	1.902	1.713	177.5	206.4	0.463	0.580
	Summer	750.0	654.9	1.956	1.840	3.2	2.9	0.008	0.008
	Fall	291.6	195.9	0.761	0.550	1.1	0.5	0.003	0.001
	Winter	241.2	150.3	0.629	0.422	0.5	0.4	0.001	0.001

Table 4.10: GAMESP Phosphorous Output
Longterm Real Conditions

Subwatershed	Year	Average PER	Total Phosphorous Delivery (kg)	Unit Area Phosphorous Delivery (kg/ha)
Essex Control	1989	1.5	911.4	3.2411
Essex Control	1990	1.5	949.8	3.3777
Essex Control	1991	1.4	999.7	3.5551
Essex Test	1989	1.4	1544.1	3.5669
Essex Test	1990	1.4	1497.7	3.4597
Essex Test	1991	1.5	1280.7	2.9584
Kettle Control	1989	2.3	90.9	0.2571
Kettle Control	1990	2.2	93.1	0.2634
Kettle Control	1991	2.3	79.3	0.2243
Kettle Test	1989	2.2	60.1	0.1467
Kettle Test	1990	2.4	34.9	0.0852
Kettle Test	1991	2.6	28.1	0.0686
Pittock Control	1989	2.1	155.9	0.4066
Pittock Control	1990	2.2	162.8	0.4246
Pittock Control	1991	2.3	128.1	0.3341
Pittock Test	1989	2.5	77.2	0.2169
Pittock Test	1990	2.8	45.4	0.1276
Pittock Test	1991	2.7	44.5	0.1250

Table 4.11: GAMES Longterm Seasonal Phosphorous Predictions; Essex Watershed

Year	Season	Total Phosphorous Delivery (kg)		Average Phosphorous Delivery (kg/ha)		Average Phosphorous Enrichment Ratio (PER)	
		Control	Test	Control	Test	Control	Test
1989	Winter	185.6	185.2	0.660	0.428	2.2	2.5
	Spring	407.4	537.9	1.449	1.243	1.8	1.9
	Summer	331.8	370.8	1.180	0.857	1.9	2.1
	Fall	210.6	171.8	0.749	0.397	2.2	2.5
1990	Winter	185.2	202.9	0.659	0.469	2.3	2.4
	Spring	353	510.3	1.255	1.179	1.9	1.9
	Summer	296.7	404.5	1.055	0.935	2.0	2.0
	Fall	165.6	198.8	0.589	0.459	2.3	2.4
1991	Winter	154.6	149.6	0.550	0.346	2.3	2.5
	Spring	384.5	506.3	1.367	1.170	1.8	1.9
	Summer	310.5	353.2	1.104	0.816	1.9	2.0
	Fall	164.2	160.5	0.584	0.371	2.3	2.5

Table 4.12: GAMES Longterm Seasonal Phosphorous Predictions; Kettle Creek Watershed

Year	Season	Total Phosphorous Delivery (kg)		Average Phosphorous Delivery (kg/ha)		Average Phosphorous Enrichment Ratio (PER)	
		Control	Test	Control	Test	Control	Test
1989	Winter	7.8	3.6	0.028	0.008	4.5	4.9
	Spring	642.5	535.2	2.285	1.237	1.5	1.5
	Summer	29.0	16.5	0.103	0.038	3.1	3.3
	Fall	6.1	3.8	0.022	0.009	4.7	4.8
1990	Winter	4.3	3.5	0.015	0.008	4.9	4.6
	Spring	486.0	384.1	1.728	0.887	1.6	1.6
	Summer	21.6	15.9	0.077	0.037	3.4	3.8
	Fall	7.6	2.8	0.027	0.006	4.3	5.1
1991	Winter	4.8	1.3	0.017	0.003	4.9	6.7
	Spring	631.2	304.6	2.245	0.704	1.5	1.6
	Summer	26.7	7.1	0.095	0.016	3.2	4.0
	Fall	5.4	1.8	0.019	0.004	4.6	5.7

Table 4.13: GAMES Longterm Seasonal Phosphorous Predictions; Pittock Watershed

Year	Season	Total Phosphorous Delivery (kg)		Average Phosphorous Delivery (kg/ha)		Average Phosphorous Enrichment Ratio (PER)	
		Control	Test	Control	Test	Control	Test
1989	Winter	7.4	4.1	0.026	0.009	4.9	5.7
	Spring	411.1	226.2	1.462	0.523	1.8	2.1
	Summer	31.4	14.4	0.112	0.033	3.4	4.1
	Fall	6.9	5.0	0.025	0.012	5.1	5.4
1990	Winter	5.8	1.7	0.021	0.004	5.2	6.8
	Spring	258.0	143.3	0.917	0.331	2.0	2.3
	Summer	18.8	7.9	0.067	0.018	3.9	4.7
	Fall	7.0	2.0	0.025	0.005	5.0	6.6
1991	Winter	3.8	1.4	0.014	0.003	5.8	7.1
	Spring	212.2	142.2	0.755	0.329	2.2	2.3
	Summer	13.1	6.9	0.047	0.016	4.2	4.8
	Fall	5.1	1.8	0.018	0.004	5.3	6.8

Table 4.14: GAMES Optimized A Value from Observed Loads

Watershed	1989	1990	1991
Essex Control	26.1	5.23	29.0
Essex Test	32.0	9.43	61.8
Kettle Creek Control	2.01	2.37	26.7
Kettle Creek Test	5.48	17.8	28.8
Pittock Control	32.7	2.39	80.4
Pittock Test	64.6	5.93	83.8

Table 4.15: GAMES Calibrated Seasonal Erosion Predictions; Essex

Year	Season	Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)		Calibrated A	
		Control	Test	Control	Test	Control	Test	Control	Test	Control	Test
1989	Spring	389.6	563.4	1.385	1.302	133.9	208.4	0.476	0.482	4.25	6.24
	Summer	162.7	271.2	0.579	0.627	43.8	42.5	0.156	0.098	219.74	190.62
	Fall	81.2	96.2	0.289	0.222	2.0	1.9	0.007	0.004	36.09	48.57
	Winter	64.5	95.6	0.229	0.221	7.2	6.5	0.026	0.015	163.25	160.46
1990	Spring	272.3	367.1	0.968	0.848	19.1	32.4	0.068	0.075	0.69	1.64
	Summer	350.5	492.4	1.246	1.138	83.7	118.4	0.298	0.274	195.06	335.47
	Fall	146.9	211.0	0.522	0.488	93.5	145.0	0.333	0.335	1443.06	2958.74
	Winter	632.7	193.3	2.250	0.447	11.7	87.7	0.042	0.203	28.46	1322.91
1991	Spring	252.5	360.3	0.898	0.832	31.2	65.6	0.111	0.152	1.20	3.22
	Summer	91.0	130.6	0.324	0.302	0.0	0.1	0.000	0.000	0.02	0.02
	Fall	132.4	195.0	0.471	0.451	2.9	12.3	0.010	0.028	36.79	164.17
	Winter	48.2	71.1	0.171	0.164	37.1	57.1	0.132	0.132	1793.40	3340.45

Table 4.16: GAMES Calibrated Seasonal Erosion Predictions; Kettle Creek

Year	Season	Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)		Calibrated A	
		Control	Test	Control	Test	Control	Test	Control	Test	Control	Test
1989	Spring	1789.8	1811.9	5.063	4.421	2.1	18.4	0.006	0.045	0.01	0.10
	Summer	1215.1	1144.1	3.437	2.792	3.4	1.1	0.010	0.003	1.37	0.36
	Fall	610.5	561.8	1.727	1.371	0.5	5.7	0.001	0.014	0.81	5.89
	Winter	374.5	314.2	1.059	0.767	7.0	16.9	0.020	0.041	11.51	30.93
1990	Spring	1861.3	1733.3	5.265	4.230	19.1	63.5	0.054	0.155	0.15	0.47
	Summer	3565.6	3230.5	10.087	7.883	43.8	113.0	0.124	0.276	8.42	17.94
	Fall	887.8	737.8	2.511	1.800	132.3	223.9	0.374	0.546	122.31	295.50
	Winter	490.3	NA	1.387	NA	41.4	NA	0.117	NA	74.99	NA
1991	Spring	1304.3	832.4	3.690	2.031	10.5	18.9	0.030	0.046	0.08	0.30
	Summer	992.4	737.5	2.807	1.800	0.0	0.0	0.000	0.000	0.00	0.00
	Fall	654.9	477.2	1.853	1.164	0.8	3.9	0.002	0.010	0.99	5.53
	Winter	674.2	554.9	1.907	1.354	136.6	119.2	0.386	0.291	200.32	198.25

Table 4.17: GAMES Calibrated Seasonal Erosion Predictions; Pittock

Year	Season	Total Gross Erosion (tonnes)		Average Erosion (tonnes/ha)		Total Sediment Delivery (tonnes)		Average Sediment Delivery (tonnes/ha)		Calibrated A	
		Control	Test	Control	Test	Control	Test	Control	Test	Control	Test
1989	Spring	1038.3	606.9	2.937	1.481	4.0	7.1	0.011	0.017	0.14	0.45
	Summer	537.6	338.3	1.521	0.826	0.0	0.0	0.000	0.000	0.18	0.11
	Fall	298.1	199.8	0.843	0.488	1.1	0.4	0.003	0.001	24.30	10.00
	Winter	188.1	120.7	0.532	0.295	14.0	12.4	0.040	0.030	355.82	573.60
1990	Spring	662.1	478.2	1.873	1.167	1.6	1.9	0.005	0.005	0.11	0.14
	Summer	1147.4	980.2	3.246	2.392	0.5	1.4	0.001	0.003	1.67	4.40
	Fall	543.3	322.9	1.537	0.788	13.7	28.3	0.039	0.069	147.44	428.20
	Winter	323.8	203.3	0.916	0.496	19.7	21.4	0.056	0.052	345.03	540.30
1991	Spring	580.7	485.4	1.643	1.184	14.2	12.9	0.040	0.031	1.23	0.98
	Summer	579.7	506.4	1.640	1.236	0.1	0.0	0.000	0.000	0.57	0.06
	Fall	235.4	158.2	0.666	0.386	0.0	0.0	0.000	0.000	0.17	0.36
	Winter	264.6	164.9	0.749	0.402	149.1	90.1	0.422	0.220	6287.80	4587.90

TABLE 5.1: PREDICTED EFFECT OF TWO EXTREME LAND MANAGEMENT SYSTEMS UPON RUNOFF, SOIL AND PHOSPHORUS LOSSES, 1989 TO 1990

Sub-Watershed	Management Practices	Total Outflow ($m^3 \times 10^6$)	Soil Loss (T)	Total Phosphorus Loss (kg)
Essex Test	Existing Care	3.34	681	1,864
	No Till	3.52 (5.4)	262 (62)	748 (60)
	Fallow	2.72 (19)	1,272 (87)	2,598 (39)
Kettle Creek Test	Existing	3.02	968	2,335
	No Till	3.13 (3.6)	723 (25)	1,706 (27)
	Fallow	2.80 (7.3)	1,630 (69)	3,885 (66)
Pittock Test	Existing	2.03	73	513
	No Till	2.25 (11)	52 (29)	424 (17)
	Fallow	2.14 (5.4)	109 (46)	706 (38)

(   )% reduction or increase from existing case.

Table 5.2: GAMES Sediment and Runoff Summary: Fallow Conditions, 1989

Subwatershed	Total Gross Erosion (tonnes)	Average Erosion (tonnes/ha)	Total Sediment To Stream (tonnes)	Average Sediment To Stream (tonnes/ha)	Delivery Ratio (%)
Essex Control	2313.5	8.2	1509.9	5.37	65.5
Essex Test	3785.6	8.7	2106.2	4.87	55.9
Kettle Control	14038.9	39.6	3045.9	8.74	22.1
Kettle Test	13382.7	32.6	3256.4	7.95	24.4
Pittock Control	10802.8	28.1	1652.3	4.31	15.3
Pittock Test	6530.8	18.2	1182.8	3.32	18.3

Table 5.3: GAMES Sediment and Runoff Summary: Calibrated Fallow Conditions, 1989 to 1991

			Essex	Essex	Kettle	Kettle	Pittock	Pittock
		Sub-watershed	Control	Test	Control	Test	Control	Test
Total		1989	1943.4	3179.9	10994.7	10480.8	7999.6	4836.1
Gross	(tonnes)	1990	2816.0	4775.1	17334.5	16443.3	13802.8	8017.7
Erosion		1991	1672.0	2791.5	10646.8	9989.8	8847.2	5415.7
Average		1989	6.91	7.31	31.10	25.54	20.87	13.47
Erosion	(tonnes/ha)	1990	10.01	10.97	49.04	40.08	36.01	22.34
		1991	5.95	6.41	30.12	24.35	23.08	15.09
Total		1989	1118.4	2310.3	377.5	627.4	630.0	564.1
Sediment		1990	2609.8	4730.5	5377.4	8054.0	7460.2	5873.9
To Stream	(tonnes)	1991	566.3	1076.4	302.2	586.5	1688.3	1709.4
Average		1989	3.98	5.31	1.07	1.53	1.64	1.57
Sediment		1990	9.28	10.87	15.21	19.63	19.46	16.37
To Stream	(tonnes/ha)	1991	2.01	2.47	0.85	1.43	4.40	4.76
Delivery		1989	57.55	72.65	3.43	5.99	7.88	11.66
Ratio	(%)	1990	92.68	99.07	31.02	48.98	54.05	73.26
		1991	33.87	38.56	2.84	5.87	19.08	31.56

Table 5.4: GAMES Sediment and Runoff Summary: No Till Conditions, 1989 to 1991

		Sub-watershed	Essex Control	Essex Test	Kettle Control	Kettle Test	Pittock Control	Pittock Test
Total		1989	200.7	366.5	1371	1049.1	570.4	444.5
Gross	(tonnes)	1990	237.5	367.3	1170.8	1170.6	674.9	488.1
Erosion		1991	226.5	361.1	1188.5	1187.1	677.5	435.7
Average		1989	0.71	0.84	3.88	2.56	1.49	1.24
Erosion	(tonnes/ha)	1990	0.84	0.84	3.31	2.85	1.76	1.36
		1991	0.81	0.83	3.36	2.89	1.77	1.21
Total		1989	38.2	53.7	40.9	48.1	10.20	6.10
Sediment		1990	45.4	52.6	46.7	108.6	14.30	7.20
To Stream	(tonnes)	1991	58.8	57.3	41.9	44.8	32.10	6.60
Average		1989	0.14	0.12	0.12	0.12	0.03	0.02
Sediment		1990	0.16	0.12	0.13	0.26	0.04	0.02
To Stream	(tonnes/ha)	1991	0.21	0.13	0.12	0.11	0.08	0.02
Delivery		1989	19.03	14.65	2.98	4.58	1.79	1.37
Ratio	(%)	1990	19.12	14.32	3.99	9.28	2.12	1.48
		1991	25.96	15.87	3.53	3.77	4.74	1.51

Table 5.5: GAMES Sediment and Runoff Summary:Calibrated No Till Conditions, 1989 to 1991

			Essex	Essex	Kettle	Kettle	Pittock	Pittock
		Sub-watershed	Control	Test	Control	Test	Control	Test
Total		1989	186.6	307.9	1073.7	821.6	422.4	329.2
Gross	(tonnes)	1990	294.5	455.4	1443.2	1442.9	869.8	629.1
Erosion		1991	166.8	265.8	902	900.9	579.7	372.8
Average		1989	0.66	0.71	3.04	2.00	1.10	0.92
Erosion	(tonnes/ha)	1990	1.05	1.05	4.08	3.52	2.27	1.75
		1991	0.59	0.61	2.55	2.20	1.51	1.04
Total		1989	20	48.1	12.4	21.6	3.30	3.50
Sediment		1990	127	226.4	132.8	384.2	111.20	68.90
To Stream	(tonnes)	1991	8.1	14.8	10.9	21.4	40.10	10.10
Average		1989	0.07	0.11	0.04	0.05	0.01	0.01
Sediment		1990	0.45	0.52	0.38	0.94	0.29	0.19
To Stream	(tonnes/ha)	1991	0.03	0.03	0.03	0.05	0.10	0.03
Delivery		1989	10.72	15.62	1.15	2.63	0.78	1.06
Ratio	(%)	1990	43.12	49.71	9.20	26.63	12.78	10.95
		1991	4.86	5.57	1.21	2.38	6.92	2.71

Table 5.6: GAMES Sediment and Runoff Summary: Essex Watershed, Real Conditions, 1989 to 1991

				Control			Test	
			Best Case	Real Conditions	Worst Case	Best Case	Real Conditions	Worst Case
Total		1989	186.6	839.7	1943.4	307.9	1285.8	3179.9
Gross	(tonnes)	1990	294.5	1212.6	2816.0	455.4	1853.8	4775.1
Erosion		1991	166.8	732.8	1672.0	265.8	1038.8	2791.5
Average		1989	0.66	2.99	6.91	0.71	2.95	7.31
Erosion	(tonnes/ha)	1990	1.05	4.31	10.01	1.05	4.26	10.97
		1991	0.59	2.61	5.95	0.61	2.39	6.41
Total		1989	20	149.0	1118.4	48.1	276.1	2310.3
Sediment		1990	127	756.4	2609.8	226.4	1204.5	4730.5
To Stream	(tonnes)	1991	8.1	49.5	566.3	14.8	74.9	1076.4
Average		1989	0.07	0.53	3.98	0.11	0.63	5.31
Sediment		1990	0.45	2.69	9.28	0.52	2.77	10.87
To Stream	(tonnes/ha)	1991	0.03	0.18	2.01	0.03	0.17	2.47
Delivery		1989	10.72	17.74	57.55	15.62	21.47	72.65
Ratio	(%)	1990	43.12	62.38	92.68	49.71	64.97	99.07
		1991	4.86	6.75	33.87	5.57	7.21	38.56

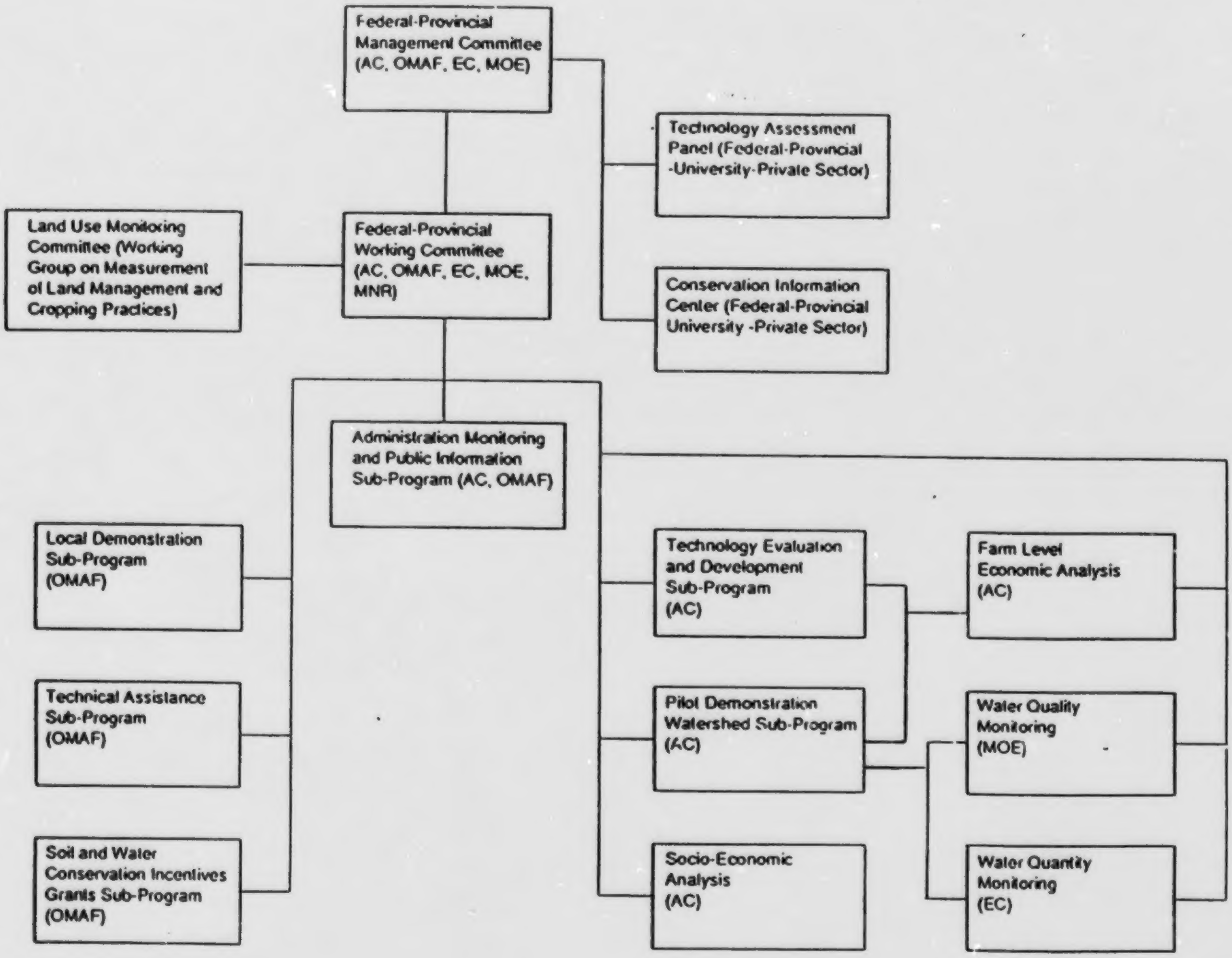
Table 5.7: GAMES Sediment and Runoff Summary: Kettle Creek Watershed, Real Conditions, 1989 to 1991

			Control			Test		
			Best Case	Real Conditions	Worst Case	Best Case	Real Conditions	Worst Case
Total		1989	1073.7	3365.6	10994.7	821.6	3323.2	10480.8
Gross	(tonnes)	1990	1443.2	5907.1	17334.5	1442.9	5142.8	16443.3
Erosion		1991	902.1	3720.4	10646.8	900.9	2522.6	9989.8
Average		1989	3.04	9.52	31.10	2.00	8.10	25.54
Erosion	(tonnes/ha)	1990	4.08	16.71	49.04	3.52	12.53	40.08
		1991	2.55	10.52	30.12	2.20	6.15	24.35
Total		1989	12.4	59.8	377.5	21.6	133.3	627.4
Sediment		1990	132.8	684.2	5377.4	384.2	896.6	8054.0
To Stream	(tonnes)	1991	10.9	57.5	302.2	21.4	85.7	586.5
Average		1989	0.04	0.17	1.07	0.05	0.32	1.53
Sediment		1990	0.38	1.94	15.21	0.94	2.19	19.63
To Stream	(tonnes/ha)	1991	0.03	0.16	0.85	0.05	0.21	1.43
Delivery		1989	1.15	1.78	3.43	2.63	4.01	5.99
Ratio	(%)	1990	9.20	11.58	31.02	26.63	17.43	48.98
		1991	1.21	1.55	2.84	2.38	3.40	5.87

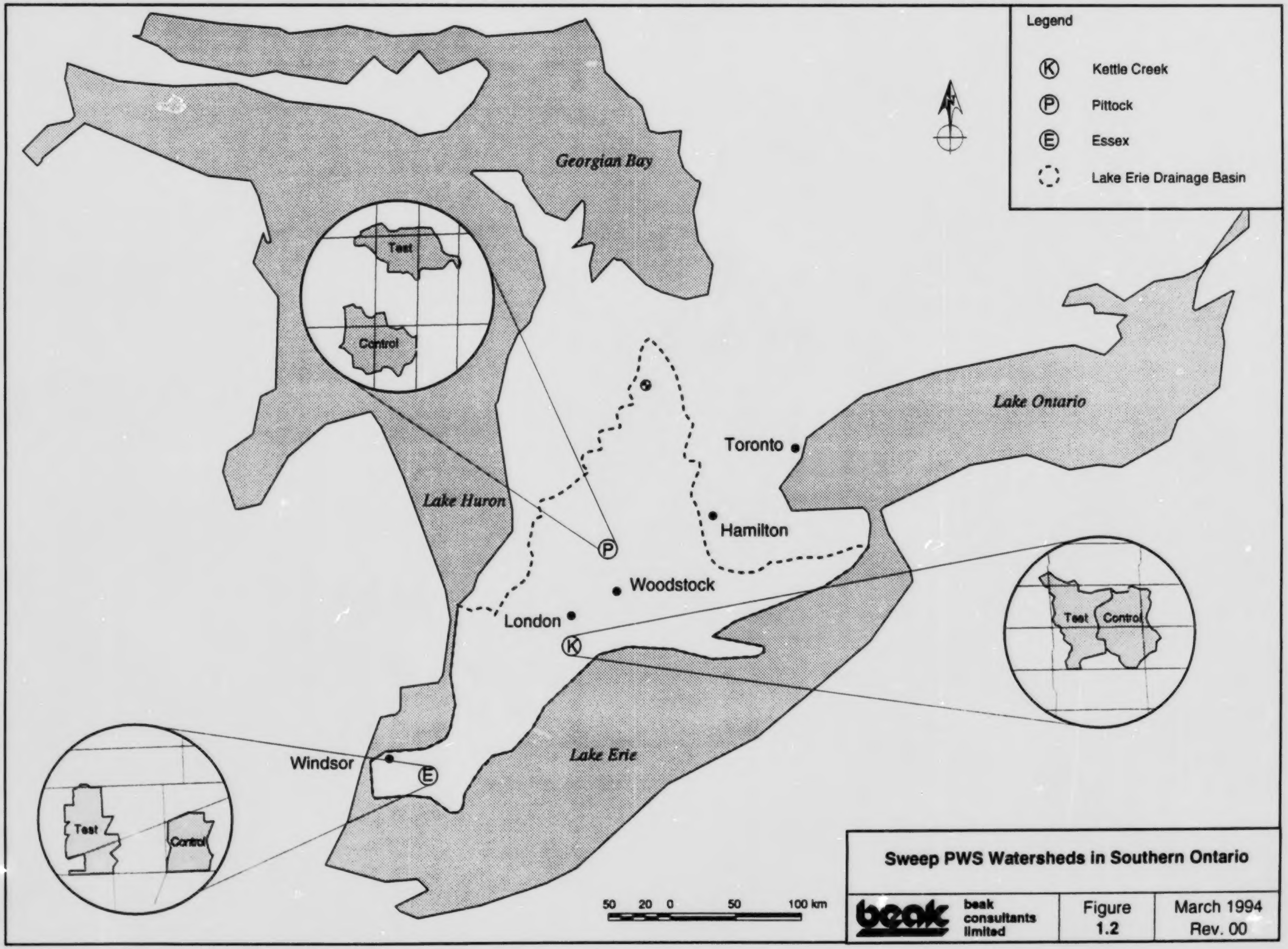
Table 5.8: GAMES Sediment and Runoff Summary: Pittock Watershed, Real Conditions, 1989 to 1991

				Control			Test	
		Sub-watershed	Best Case	Real Conditions	Worst Case	Best Case	Real Conditions	Worst Case
Total		1989	422.4	2138.0	7999.6	329.2	1397.4	4836.1
Gross	(tonnes)	1990	869.8	3829.9	13802.8	629.1	2219.7	8017.7
Erosion		1991	579.7	2545.1	8847.2	372.8	1556.9	5415.7
Average		1989	1.10	5.58	20.87	0.92	3.89	13.47
Erosion	(tonnes/ha)	1990	2.27	9.99	36.01	1.75	6.18	22.34
		1991	1.51	6.64	23.08	1.04	4.34	15.09
Total		1989	3.30	22.5	630.0	3.50	15.8	564.1
Sediment		1990	111.20	542.7	7460.2	68.90	404.7	5873.9
To Stream	(tonnes)	1991	40.10	78.4	1688.3	10.10	65.8	1709.4
Average		1989	0.01	0.06	1.64	0.01	0.04	1.57
Sediment		1990	0.29	1.42	19.46	0.19	1.13	16.37
To Stream	(tonnes/ha)	1991	0.10	0.20	4.40	0.03	0.18	4.76
Delivery		1989	0.78	1.05	7.88	1.06	1.13	11.66
Ratio	(%)	1990	12.78	14.17	54.05	10.95	18.23	73.26
		1991	6.92	3.08	19.08	2.71	4.23	31.56

Figure 1.1: SWEEP Organizational Structure


Federal-Provincial Management Committee (AC, OMAF, EC, MOE)
Technology Assessment Panel (Federal-Provincial -University-Private Sector)
Land Use Monitoring Committee (Working Group on Measurement of Land Management and Cropping Practices)
Federal-Provincial Working Committee (AC, OMAF, EC, MOE, MNR)
Conservation Information Center (Federal-Provincial University -Private Sector)
Administration Monitoring and Public Information Sub-Program (AC, OMAF)
Local Demonstration Sub-Program (OMAF)
Technology Evaluation and Development Sub-Program (AC)
Farm Level Economic Analysis (AC)
Technical Assistance Sub-Program (OMAF)
Pilot Demonstration Watershed Sub-Program (AC)
Water Quality Monitoring (MOE)
Soil and Water Conservation Incentives Grants Sub-Program (OMAF)
Socio-Economic Analysis (AC)
Water Quantity Monitoring (EC)

Abbreviations
AC Agriculture Canada
EC Environment Canada
MNR Ontario Ministry of Natural Resources
MOE Ontario Ministry of the Environment
OMAF Ontario Ministry of Agriculture and Food


Legend
Ⓚ Kettle Creek
Ⓟ Pittock
Ⓔ Essex
Lake Erie Drainage Basin
Georgian Bay
Lake Huron
Lake Ontario
Lake Erie
Toronto
Hamilton
Woodstock
London
Windsor
K
P
E
Test
Control
Test
Control
Test
Control
50 20 0 50 100 km

Sweep PWS Watersheds in Southern Ontario

beak consultants limited

Figure 1.2

March 1994
Rev. 00

Figure 2.1: Kettle Creek Test Discretized Land Use Classes

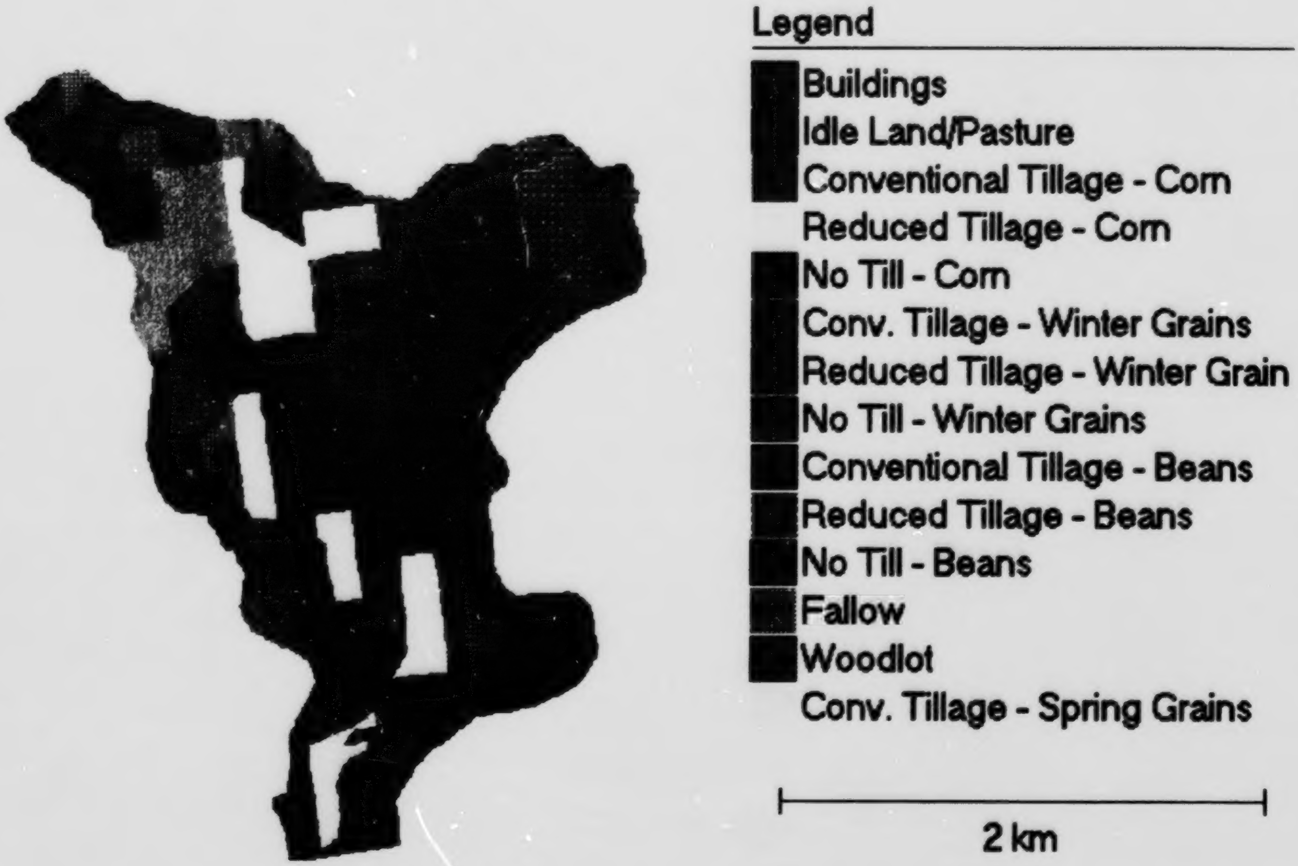

Legend
Buildings
Idle Land/Pasture
Conventional Tillage - Corn
Reduced Tillage - Corn
No Till - Corn
Conv. Tillage - Winter Grains
Reduced Tillage - Winter Grain
No Till - Winter Grains
Conventional Tillage - Beans
Reduced Tillage - Beans
No Till - Beans
Fallow
Woodlot
Conv. Tillage - Spring Grains
2 km

Figure 2.2: Kettle Creek Test Elevation Contours

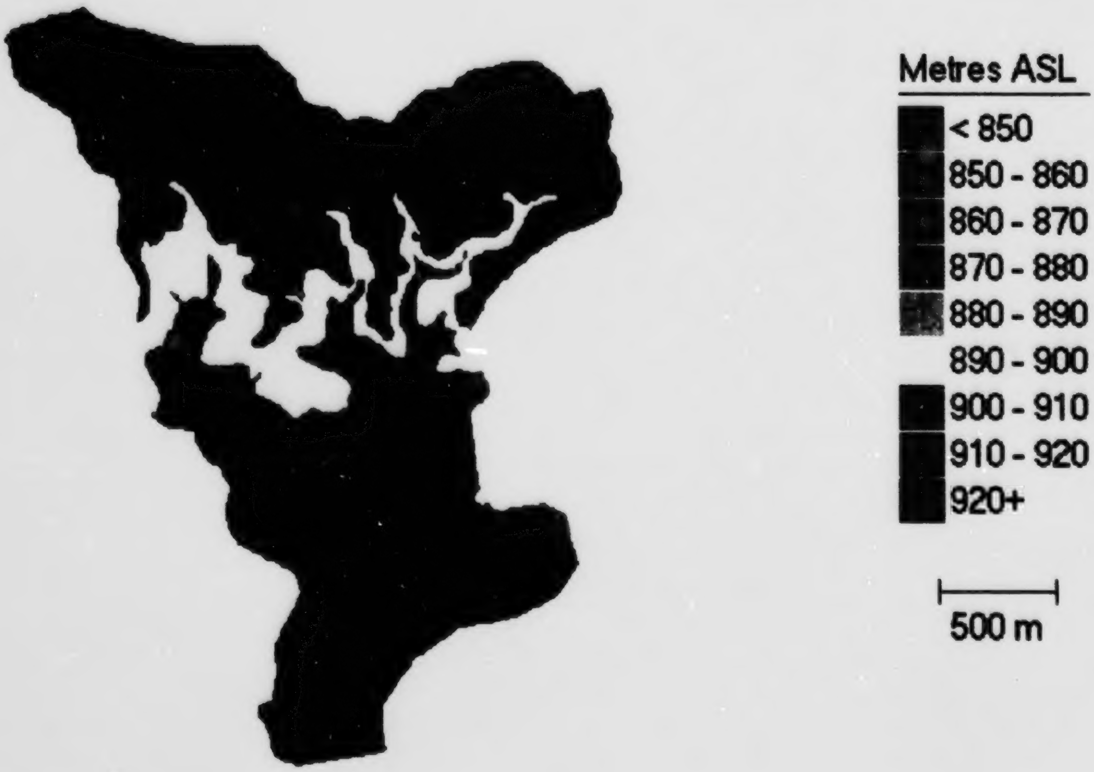

Metres ASL
< 850
850 - 860
860 - 870
870 - 880
880 - 890
890 - 900
900 - 910
910 - 920
920+
500 m

Figure 2.3: Kettle Creek Test Drainage Classes

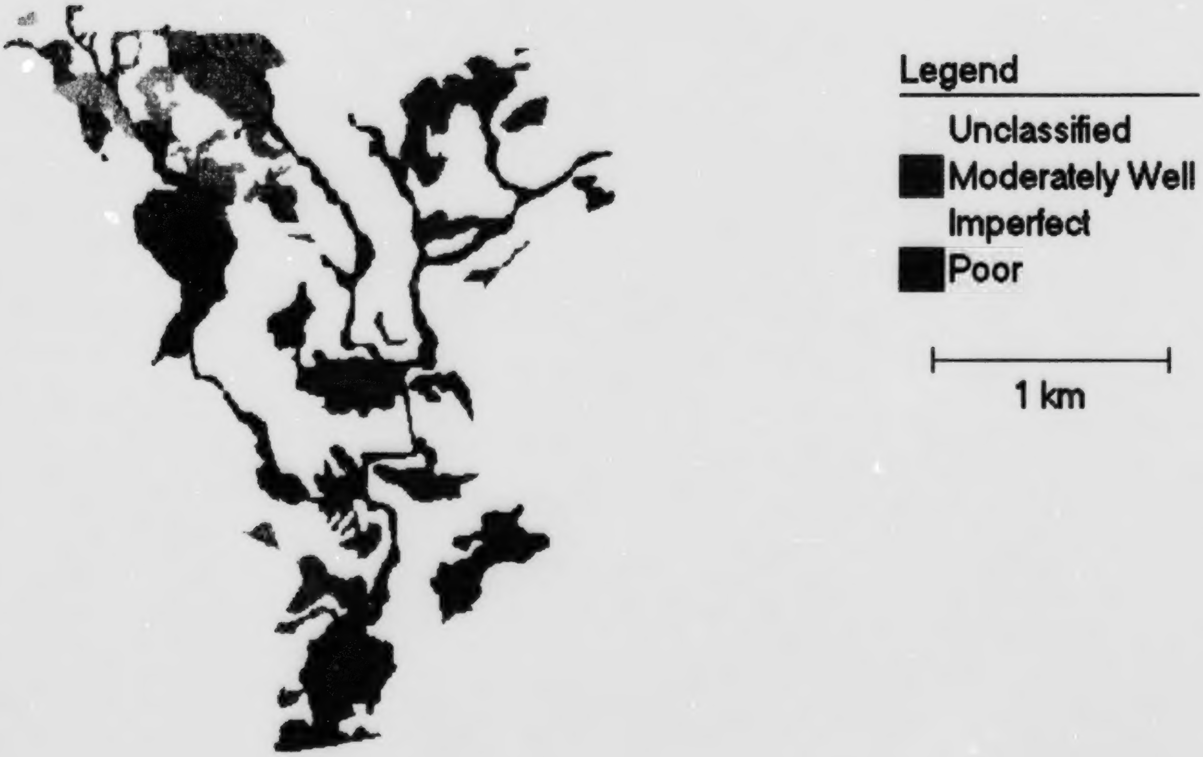
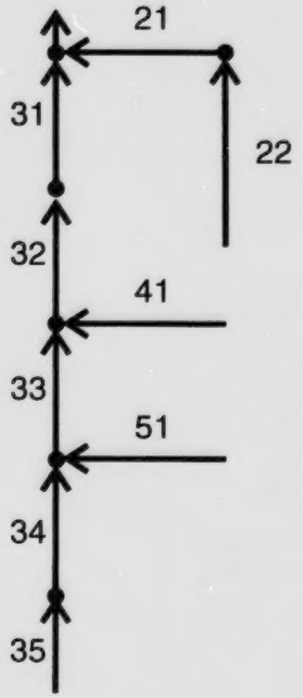

Legend
Unclassified
Moderately Well
Imperfect
Poor
1 km

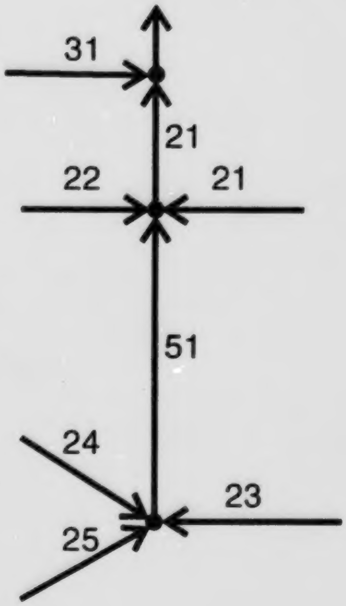
FIGURE 2.4
Essex Sub-Watersheds Drainage System Schematic

Essex Test


21
31
22
32
41
33
51
34
35

Catchment Number	Area (ha)
21	58
22	83
31	23
32	29
33	60
34	50
35	116
41	8
51	8
	435

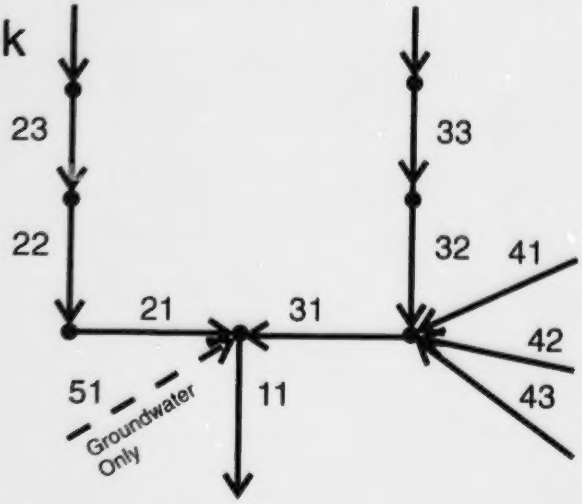
Essex Control


31
21
22
21
51
24
23
25

Catchment Number	Area (ha)
21	29
22	74
23	44
24	60
25	10
31	50
41	12
51	0
	279

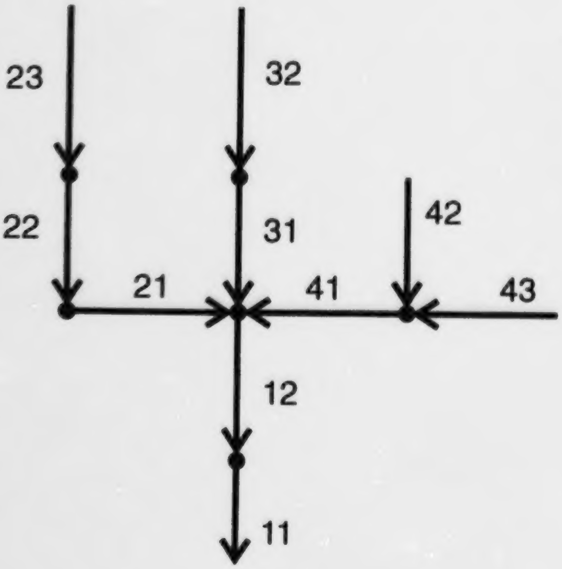
FIGURE 2.5
Kettle Creek Sub-Watersheds Drainage System Schematic

Kettle Creek Test


23
33
22
32
41
21
31
42
51
Groundwater Only
11
43

Catchment Number	Area (ha)
11	59
21	46
22	46
23	38
31	31
32	43
33	25
34	5
41	26
42	6
43	62
51	23
	410

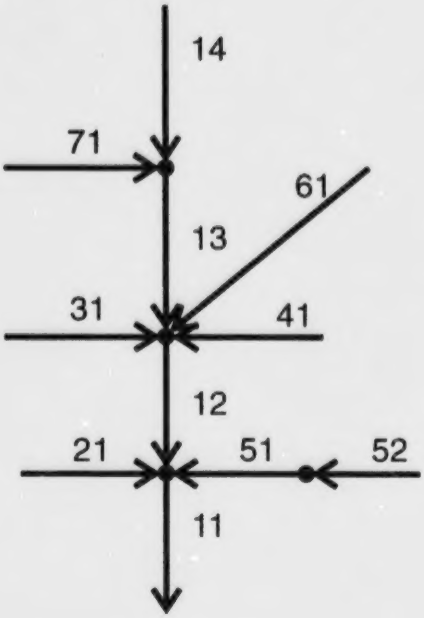
Kettle Creek Control


23
32
22
31
42
21
41
43
12
11

Catchment Number	Area (ha)
11	77
12	0
21	53
22	50
23	53
31	11
32	13
41	56
42	30
43	5
	348

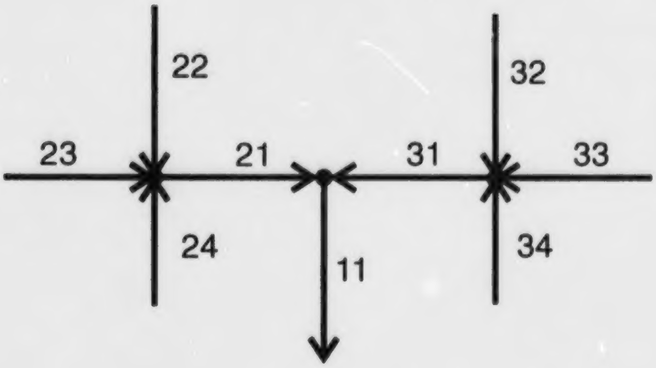
FIGURE 2.6
Pittock Sub-Watersheds Drainage System Schematic

Pittock Test


14
71
61
13
31
41
12
21
51
52
11

Catchment Number	Area (ha)
11	20
12	23
13	86
14	28
21	38
31	31
41	41
51	32
52	25
61	18
71	17
	359

Pittock Control


22
32
23
21
31
33
24
11
34

Catchment Number	Area (ha)
11	0
21	99
22	35
23	36
24	21
31	75
32	31
33	60
34	21
	378

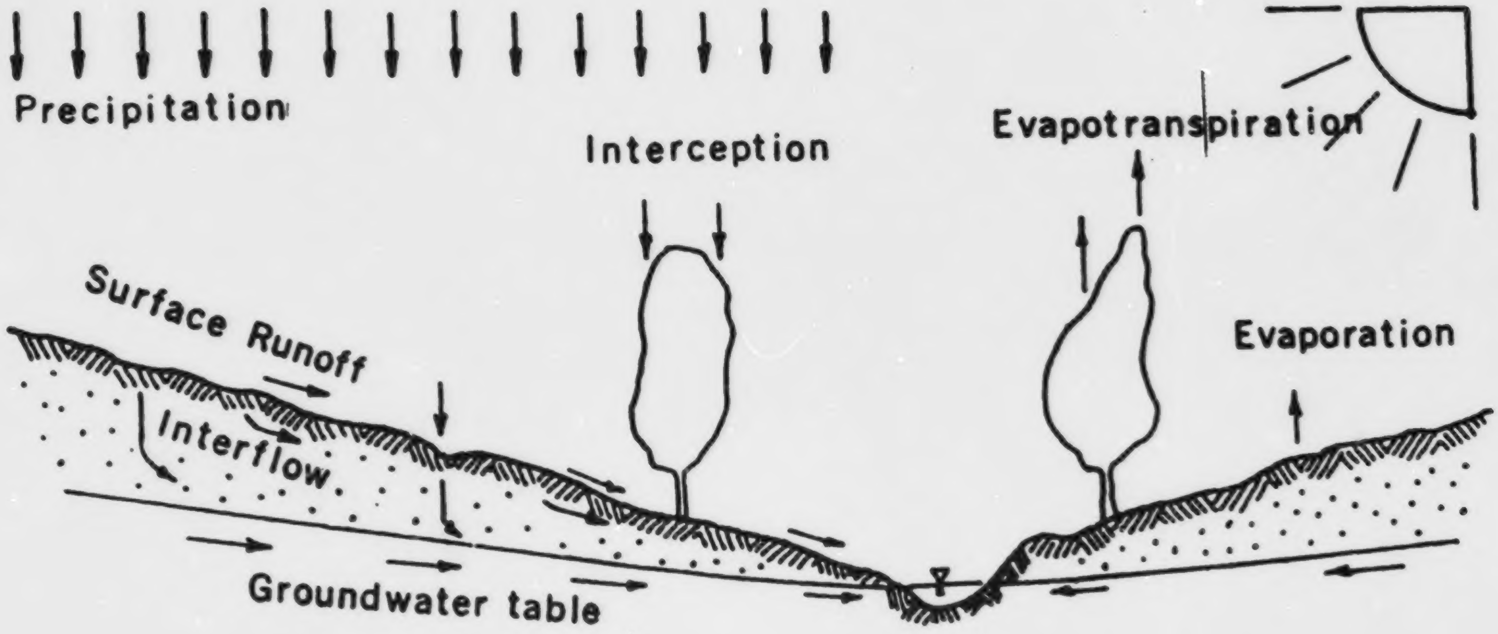

Precipitation
Interception
Evapotranspiration
Evaporation
Surface Runoff
Interflow
Groundwater table

Figure 3.1 Hydrologic Cycle

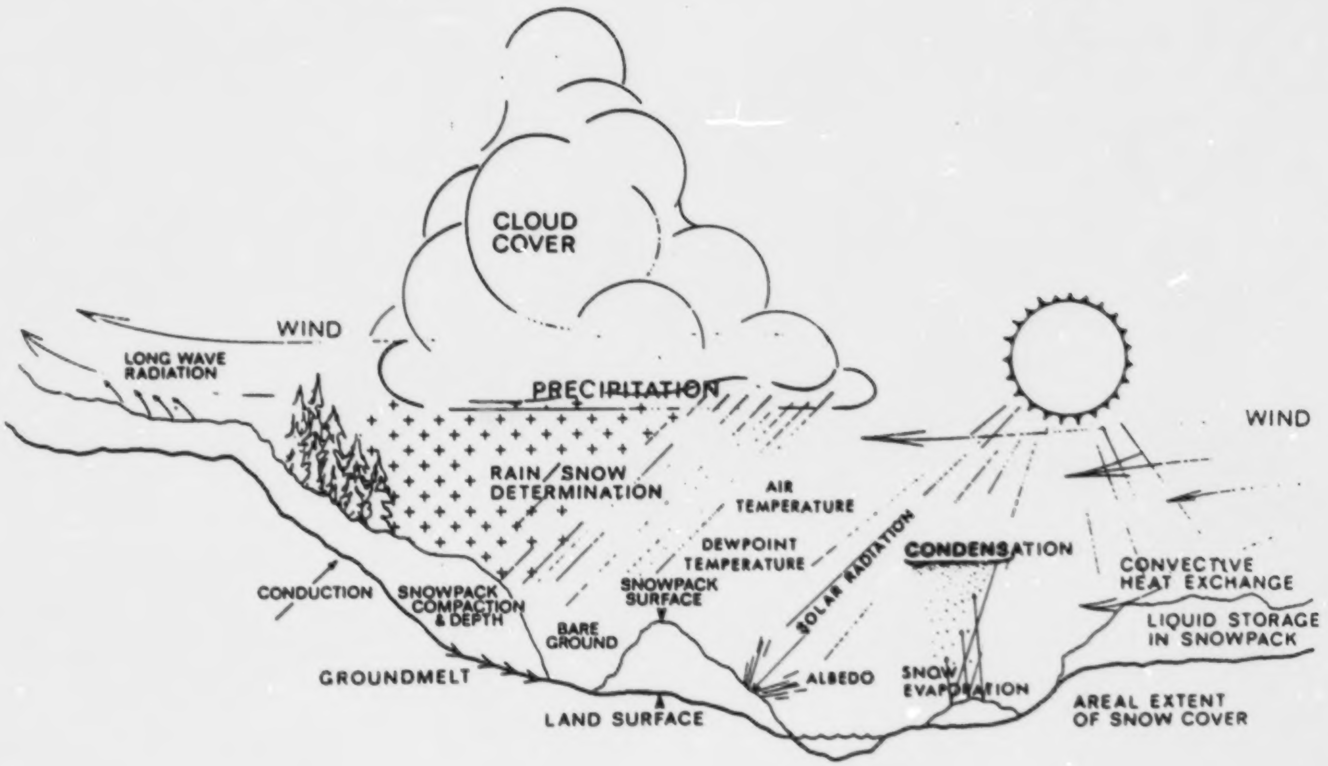
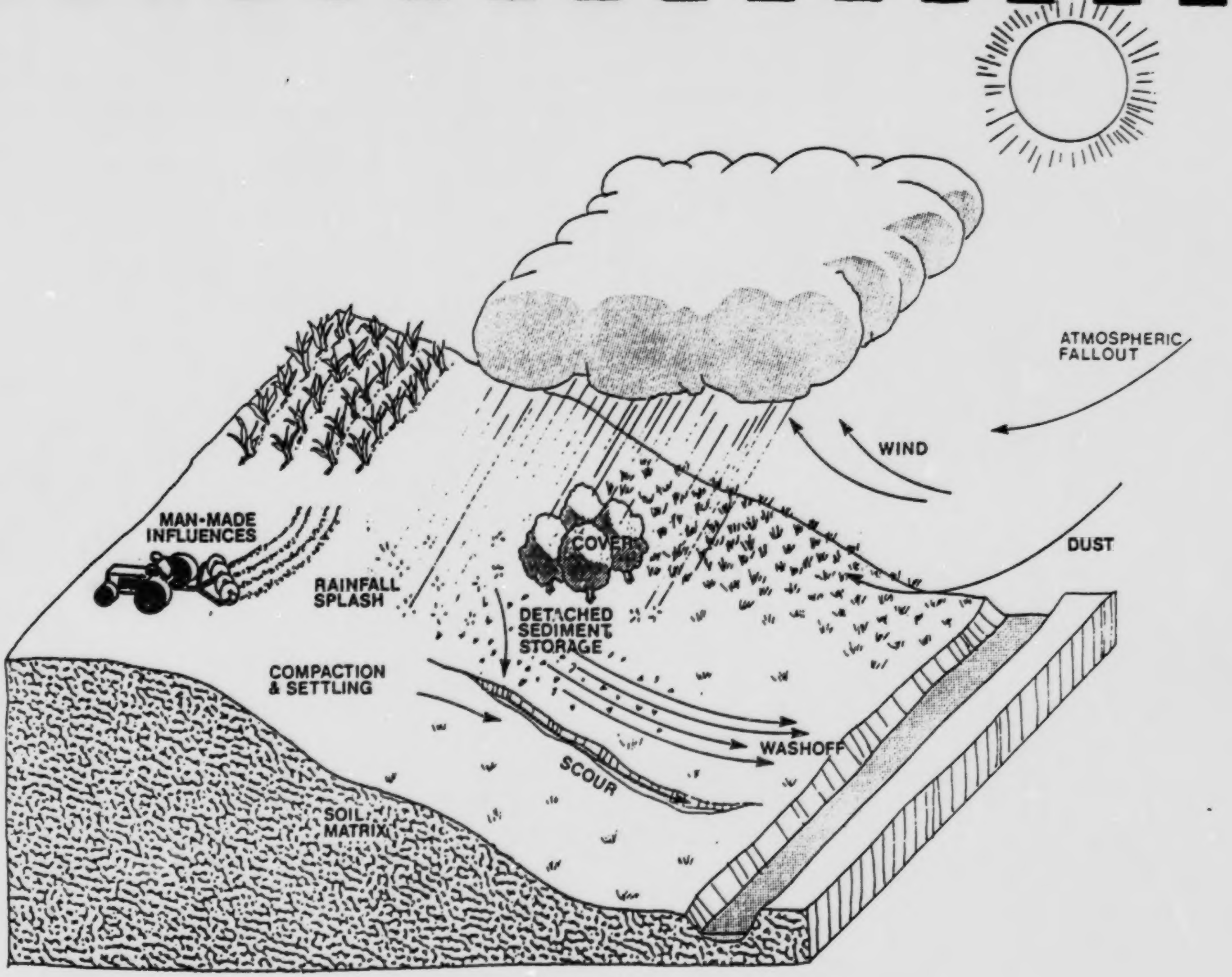

CLOUD COVER
WIND
LONG WAVE RADIATION
PRECIPITATION
WIND
RAIN/SNOW DETERMINATION
AIR TEMPERATURE
DEWPOINT TEMPERATURE
SOLAR RADIATION
CONDENSATION
CONVECTIVE HEAT EXCHANGE
LIQUID STORAGE IN SNOWPACK
CONDUCTION
SNOWPACK COMPACTION & DEPTH
SNOWPACK SURFACE
BARE GROUND
GROUNDMELT
ALBEDO
SNOW EVAPORATION
AREAL EXTENT OF SNOW COVER
LAND SURFACE

Figure 3.2 Snow Accumulation and Melt Processes



ATMOSPHERIC FALLOUT
WIND
DUST
MAN-MADE INFLUENCES
RAINFALL SPLASH
COVER
DETACHED SEDIMENT STORAGE
COMPACTION & SETTLING
WASHOFF
SCOUR
SOIL MATRIX

Figure 3.3 Erosion Processes

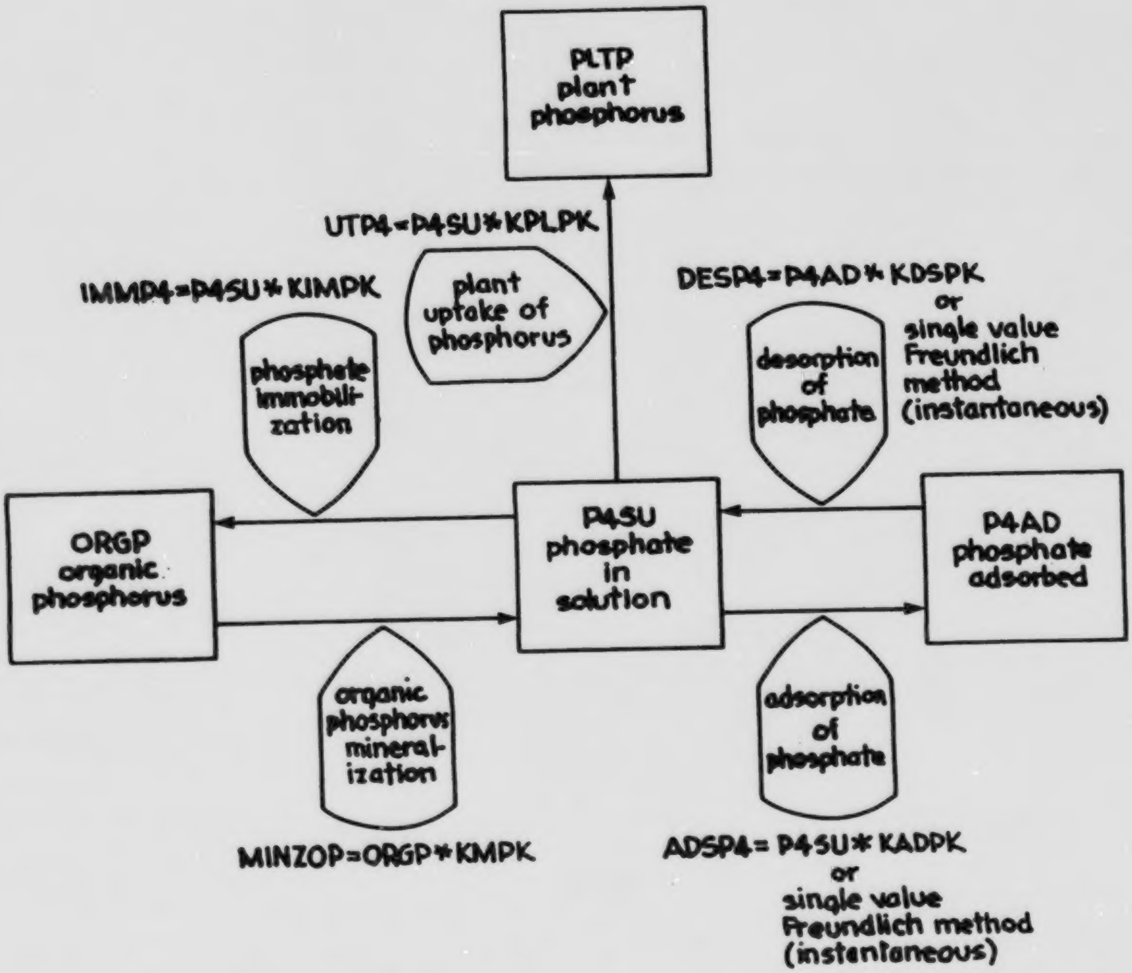
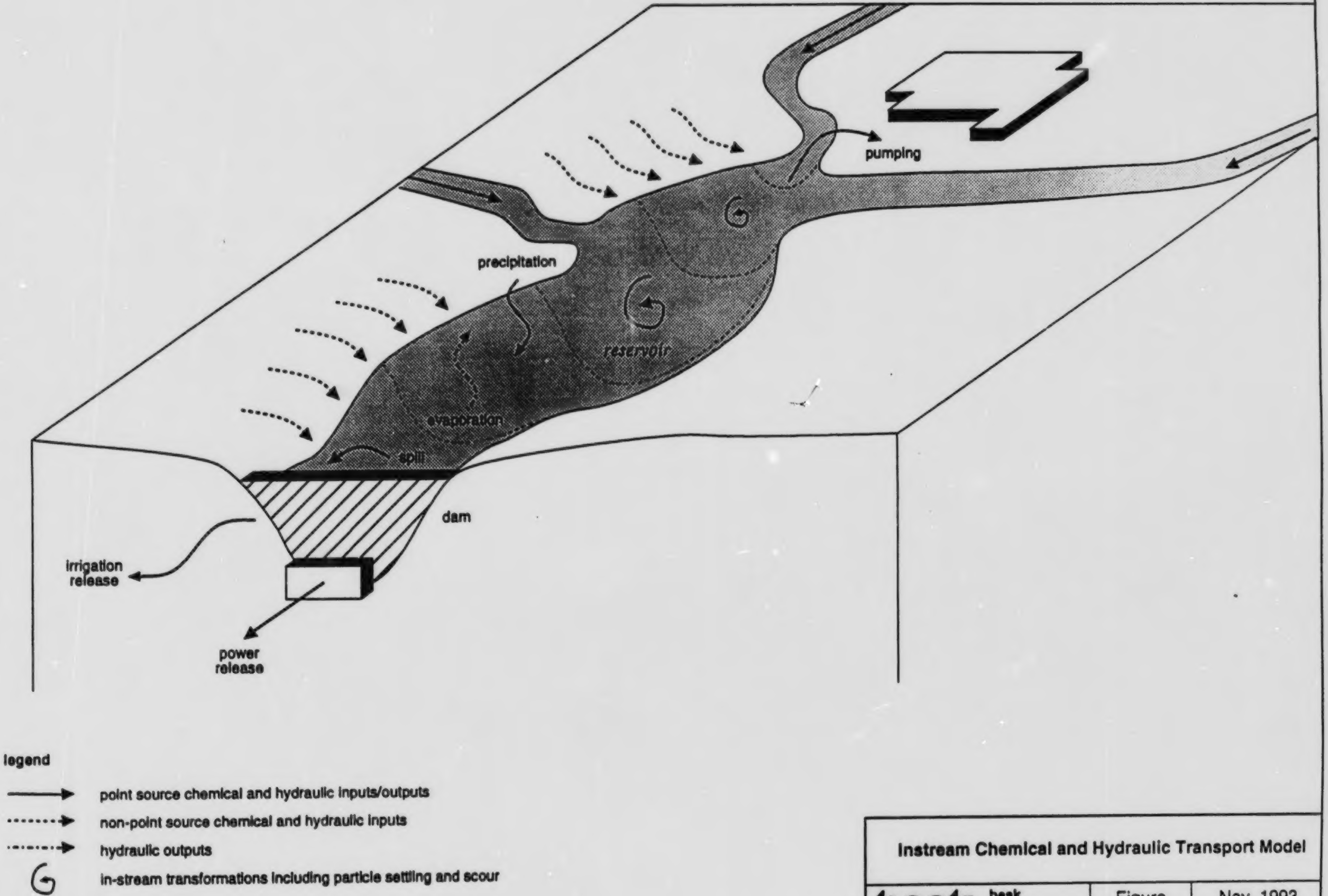

PLTP
plant
phosphorus
UTP4=P4SU*KPLPK
plant
uptake of
phosphorus
IMMP4=P4SU*KIMPK
phosphate
immobilization
DESP4=P4AD*KDSPK
or
single value
Freundlich
method
(instantaneous)
desorption
of
phosphate
ORGP
organic
phosphorus
P4SU
phosphate
in
solution
P4AD
phosphate
adsorbed
organic
phosphorus
mineralization
adsorption
of
phosphate
MINZOP=ORGP*KMPK
ADSP4= P4SU*KADPK
or
single value
Freundlich method
(instantaneous)

Figure 3.4: Flow Diagram for Phosphorus Reactions


pumping
precipitation
reservoir
evaporation
spill
dam
irrigation release
power release
legend
point source chemical and hydraulic inputs/outputs
non-point source chemical and hydraulic inputs
hydraulic outputs
in-stream transformations including particle settling and scour

Instream Chemical and Hydraulic Transport Model

beak consultants limited

Figure 3.5

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Figure 4.1: Essex Test Streamflow, 1989

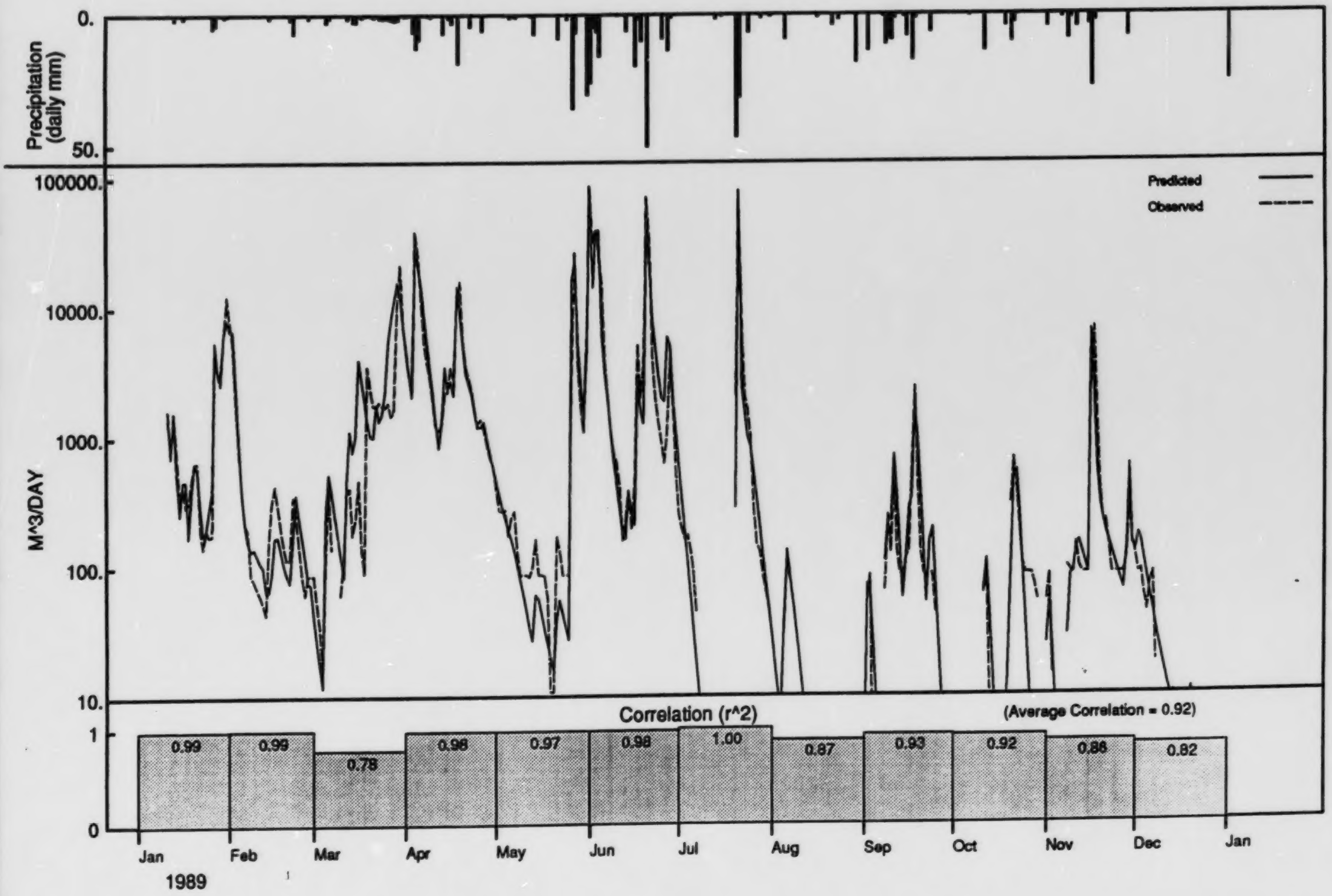


Figure 4.2: Essex Test Cumulative Streamflow, 1989

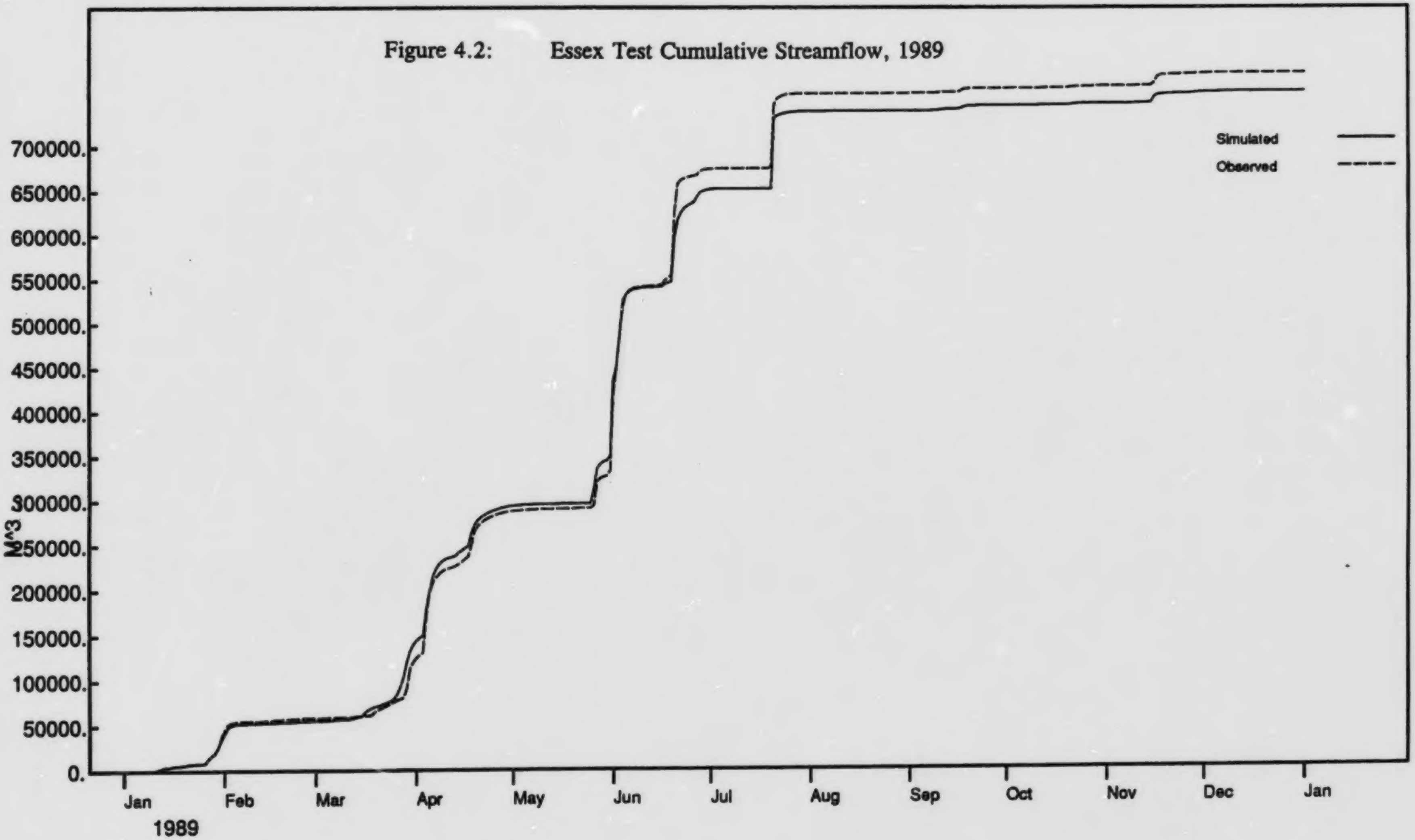


Figure 4.3: Essex Control Streamflow, 1989

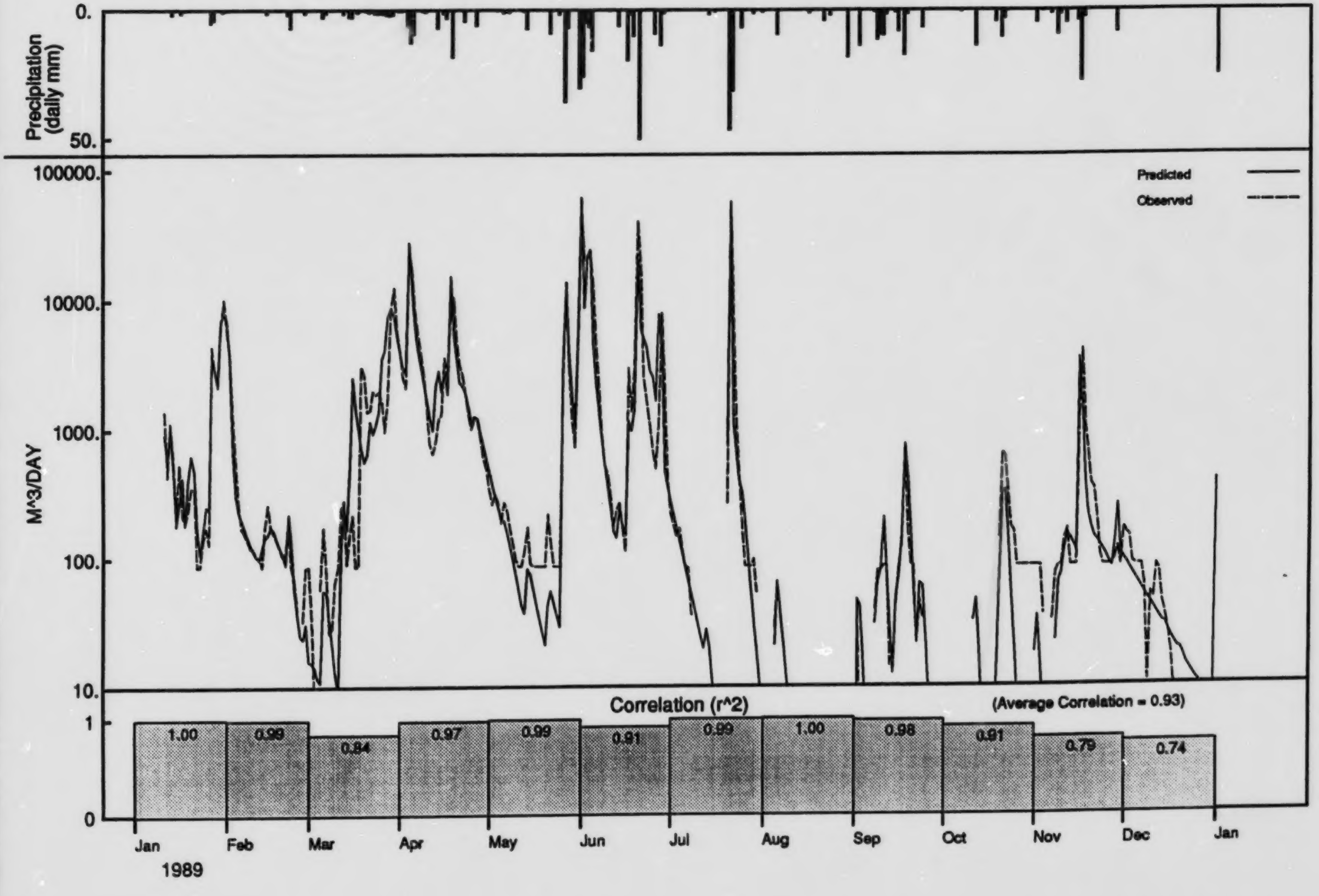


Figure 4.4: Essex Control Cumulative Streamflow, 1989

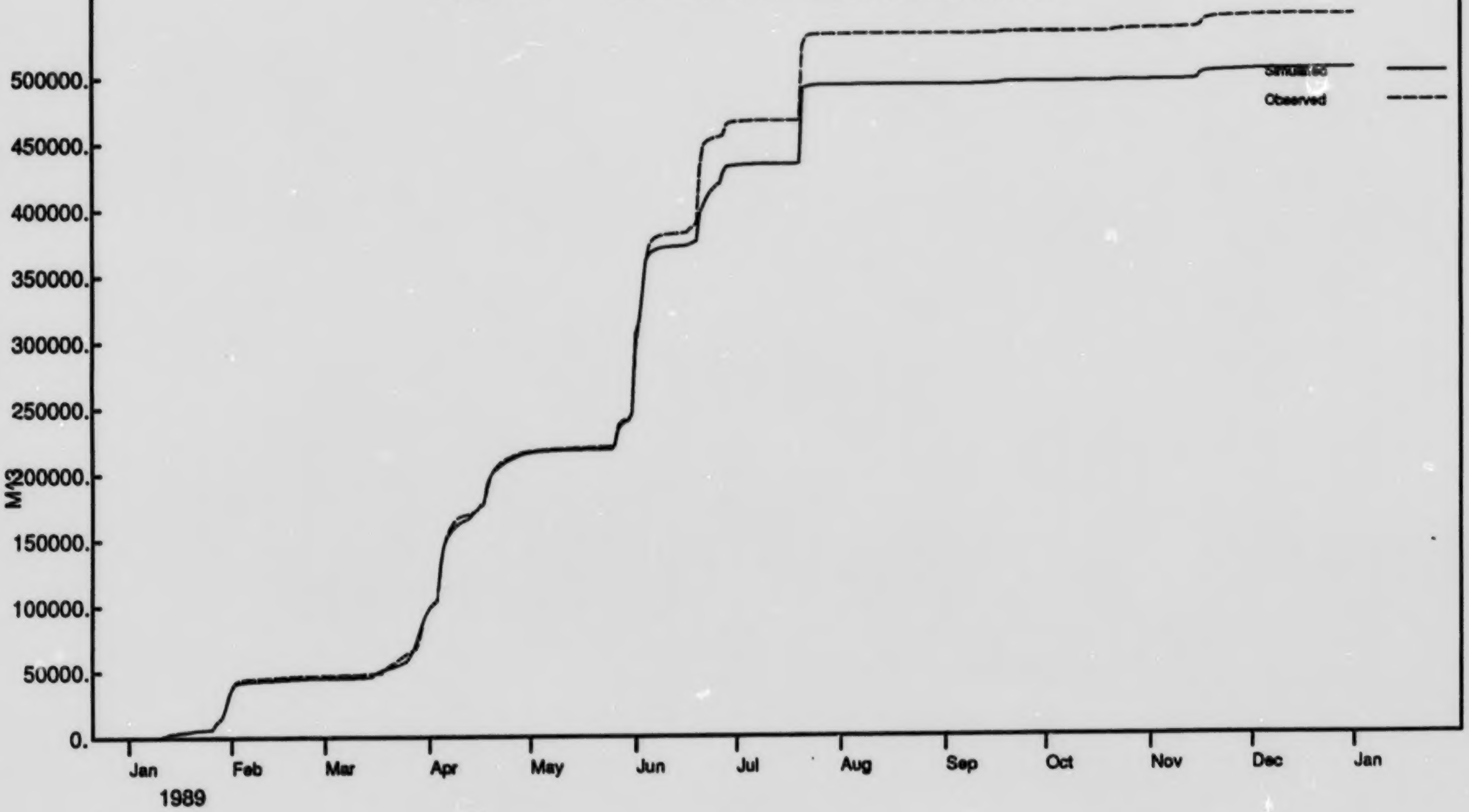


Figure 4.5: Essex Test Soil Loss, 1989

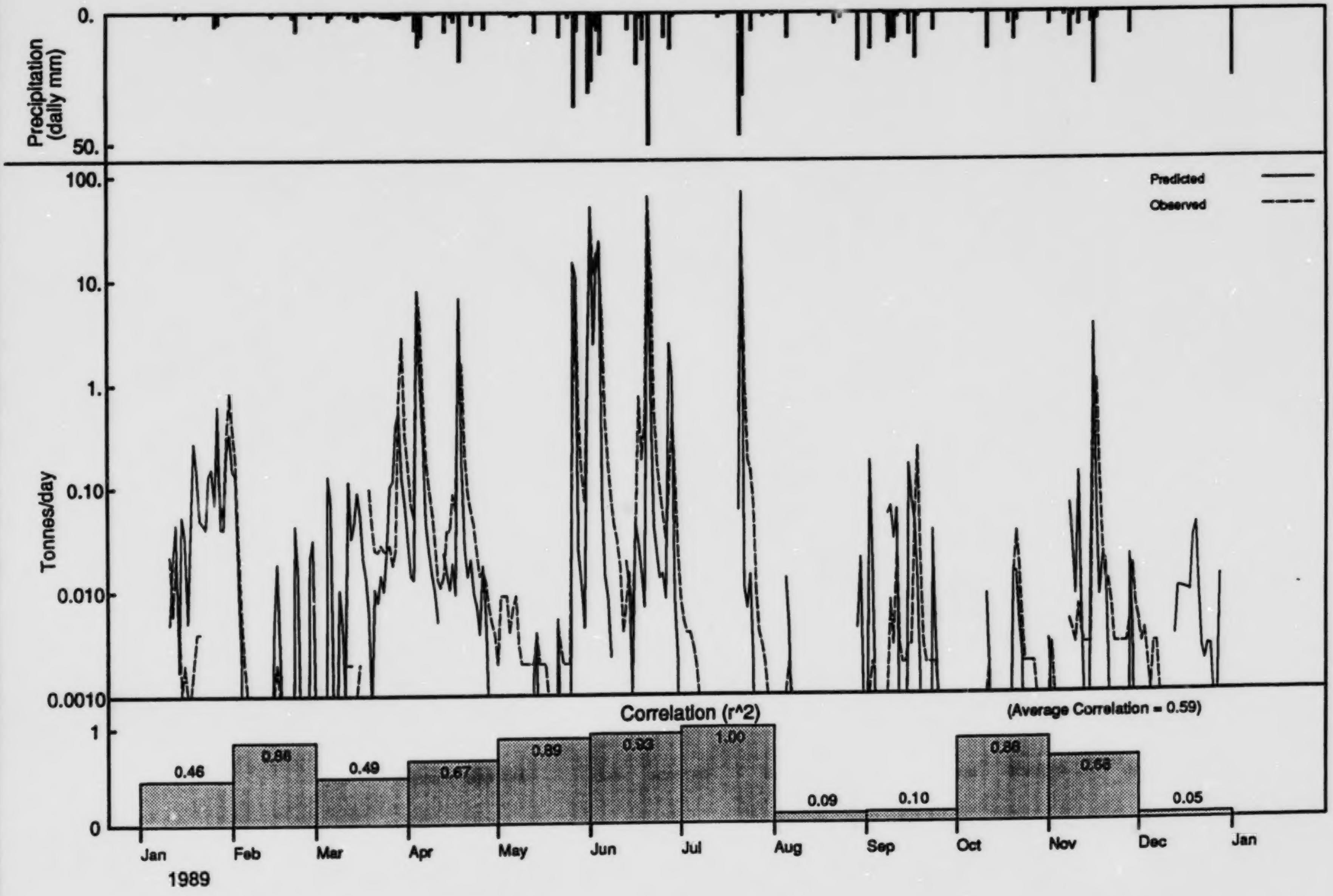


Figure 4.6: Essex Test Cumulative Soil Loss, 1989

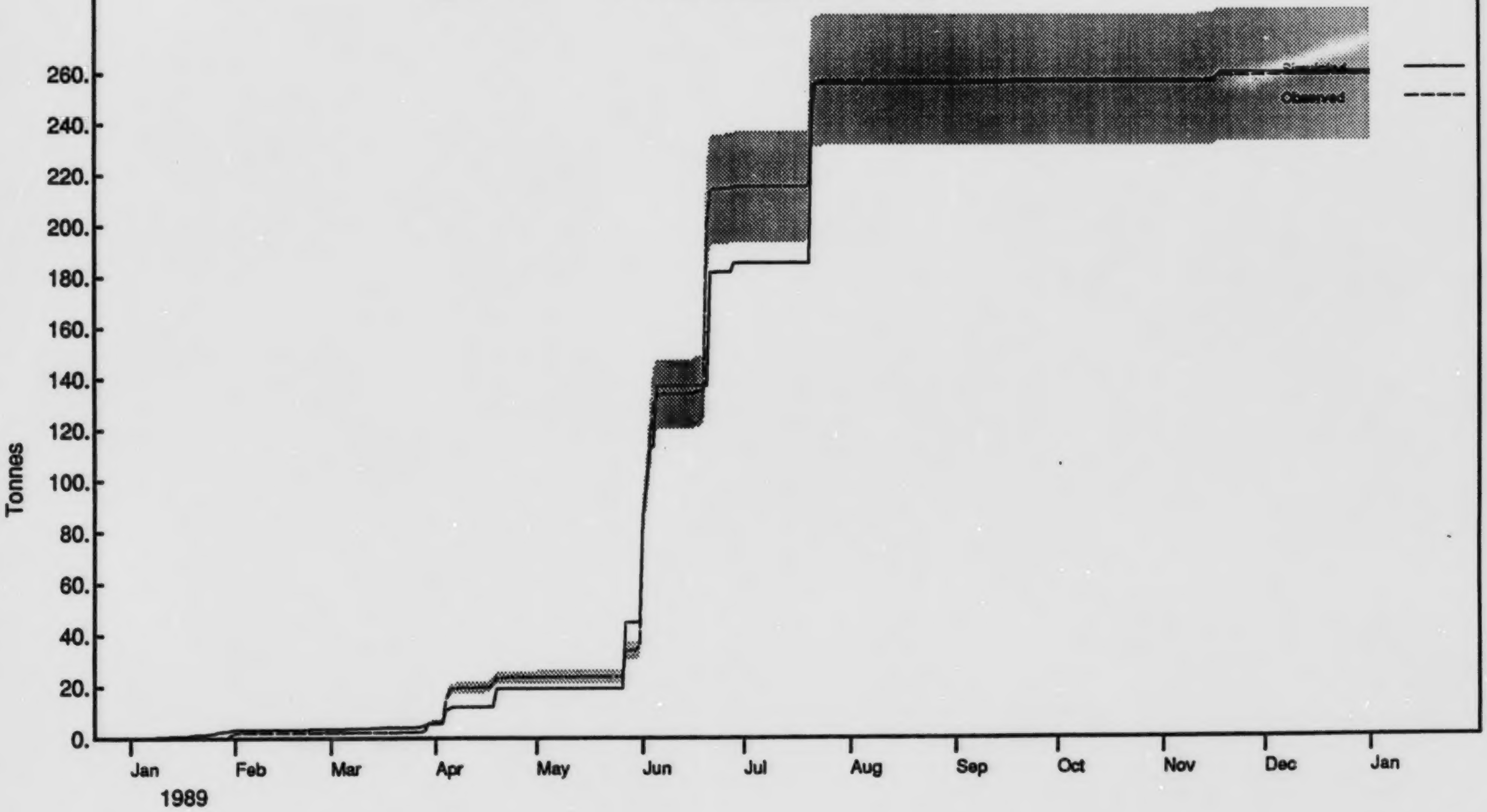


Figure 4.7: Essex Control Soil Loss, 1989

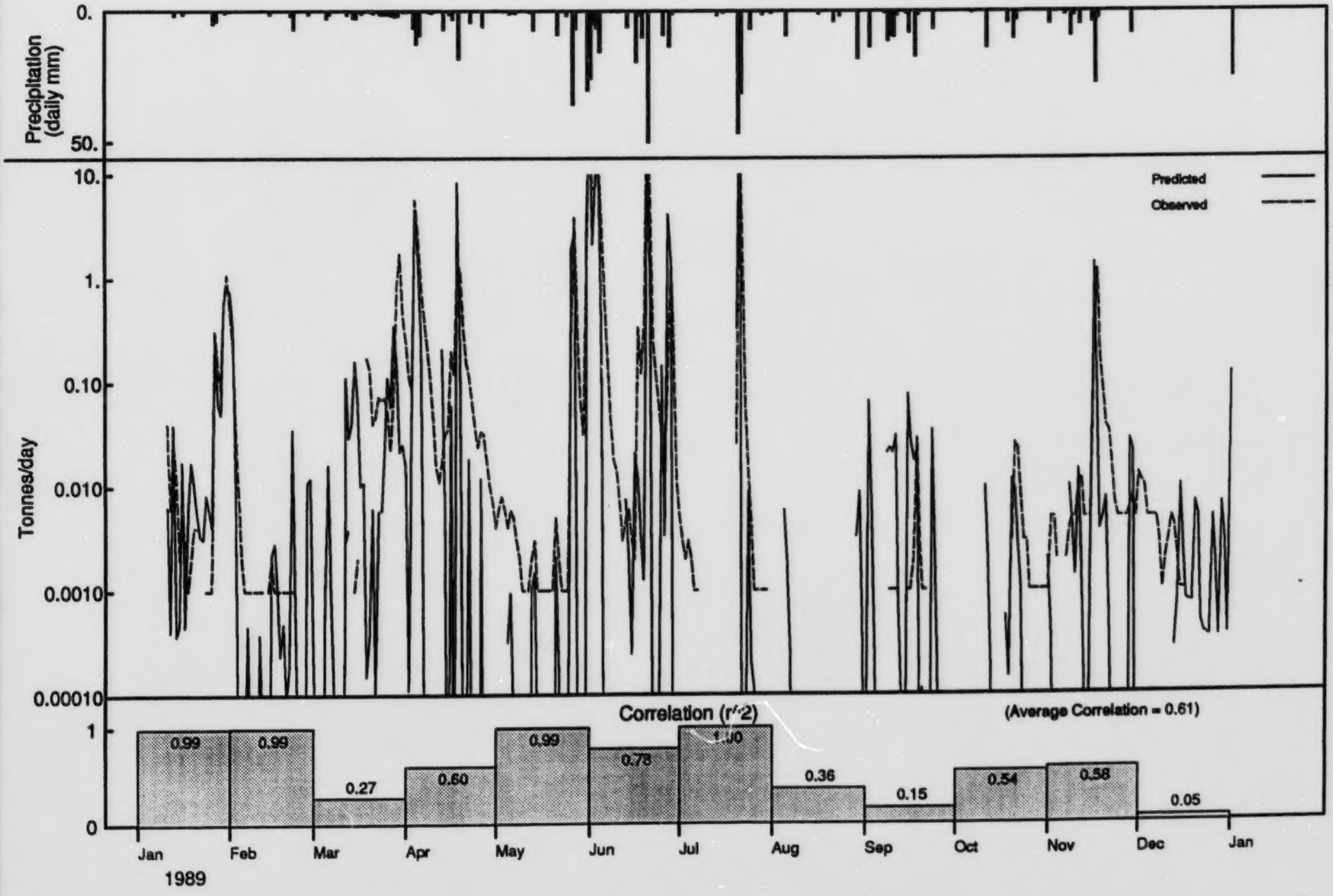


Figure 4.8: Essex Control Cumulative Soil Loss, 1989

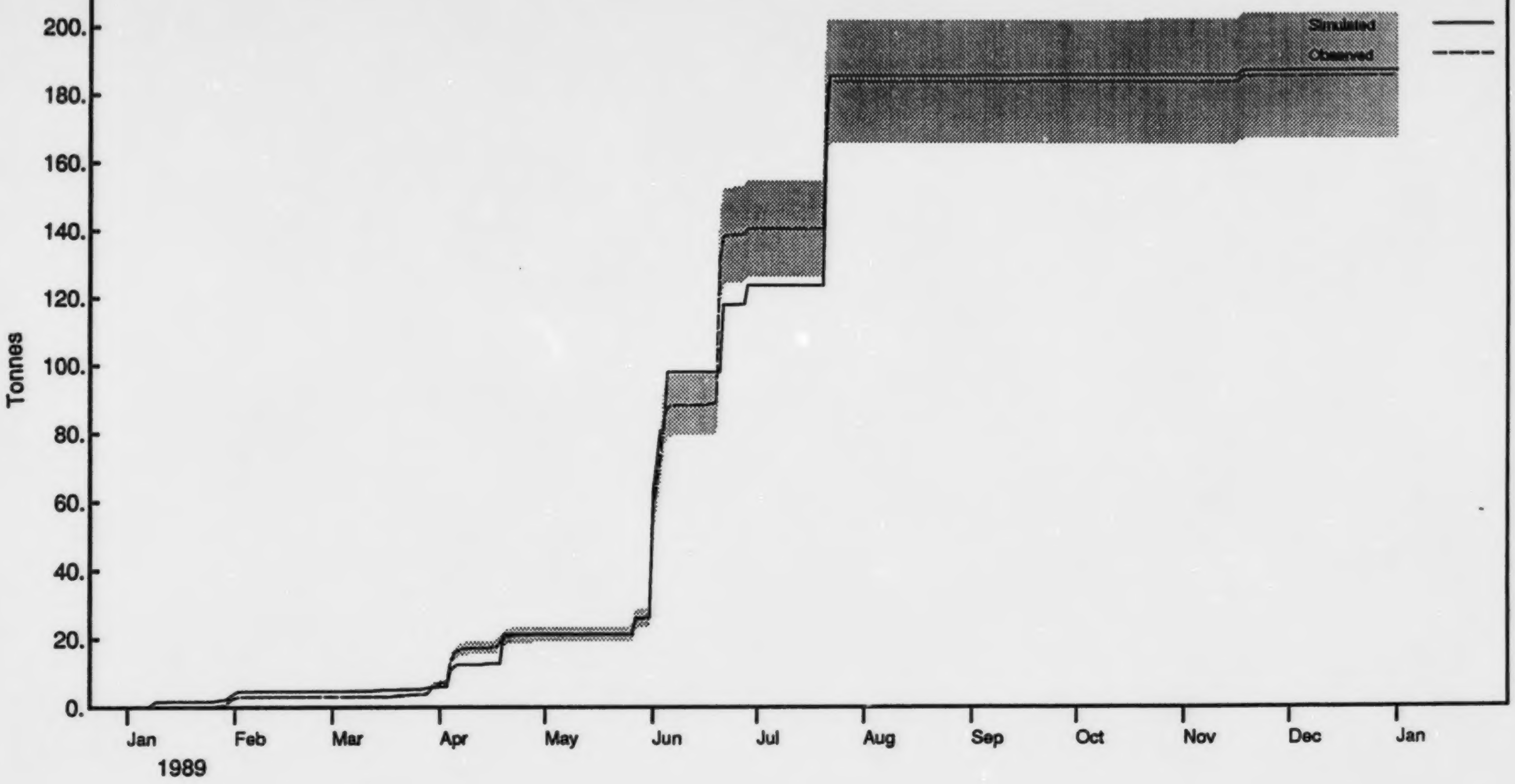


Figure 4.9: Essex Test Phosphorus Loss, 1989

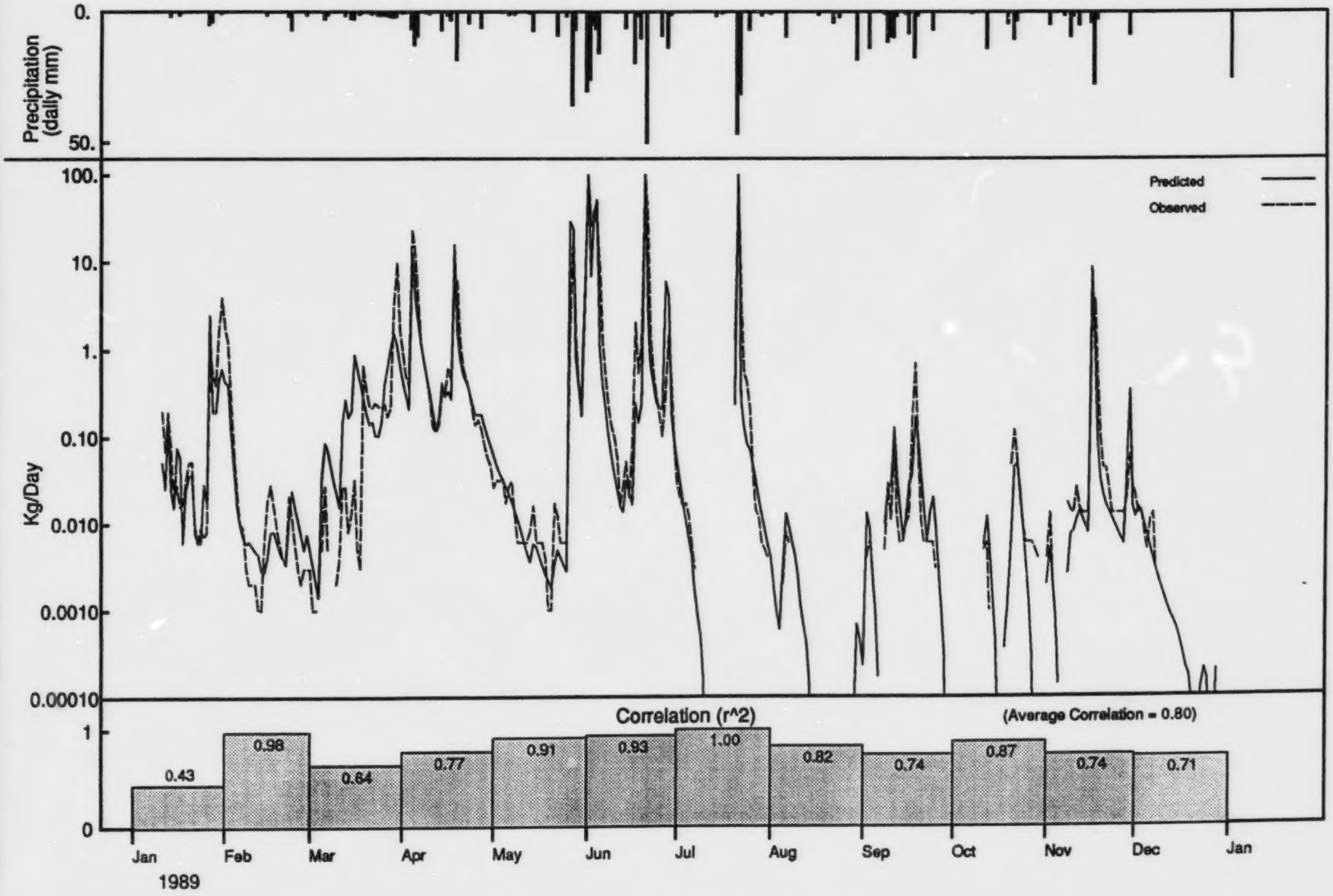


Figure 4.10: Essex Test Cumulative Phosphorus Loss, 1989

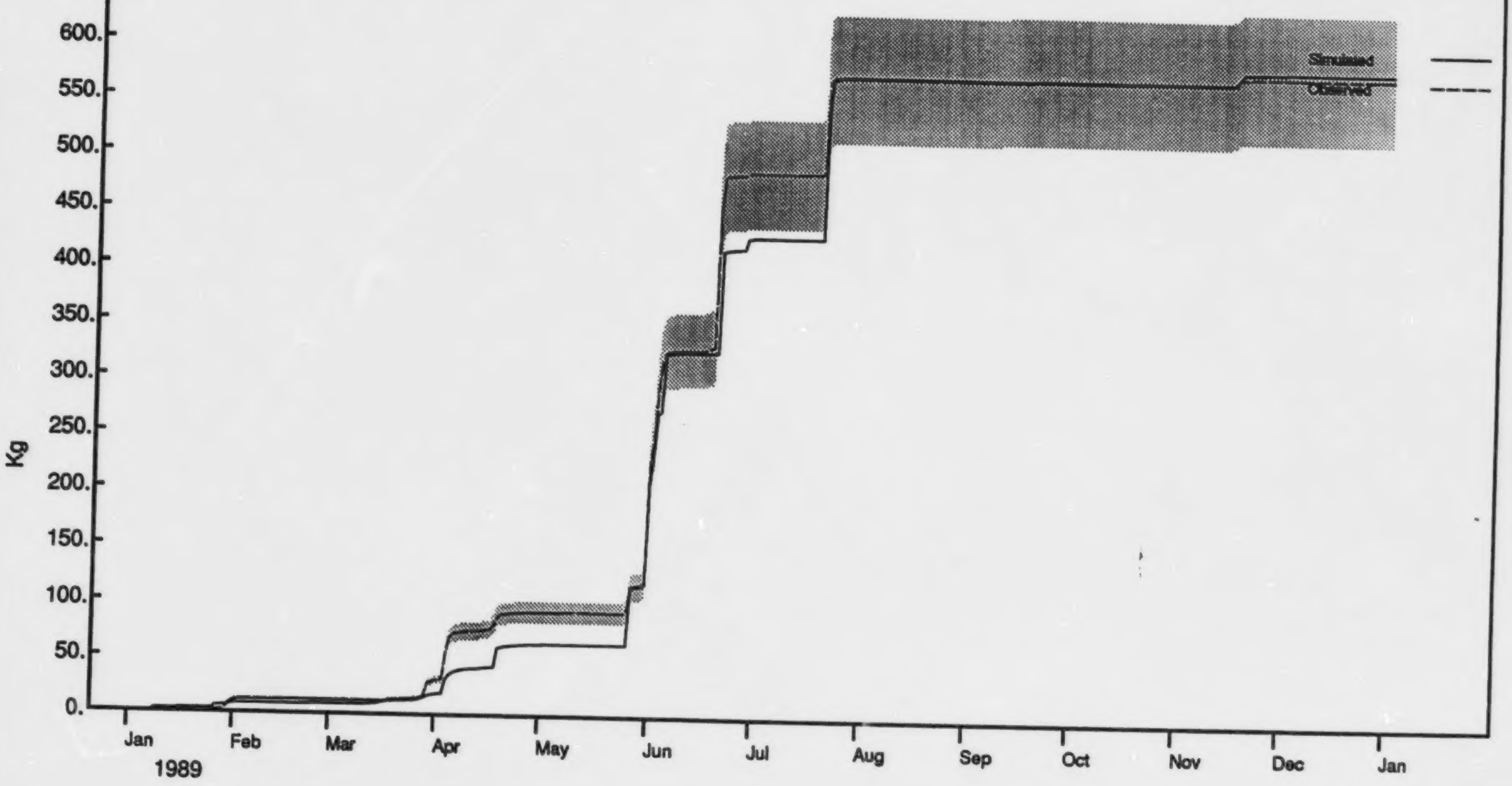


Figure 4.11: Essex Control Phosphorus Loss, 1989

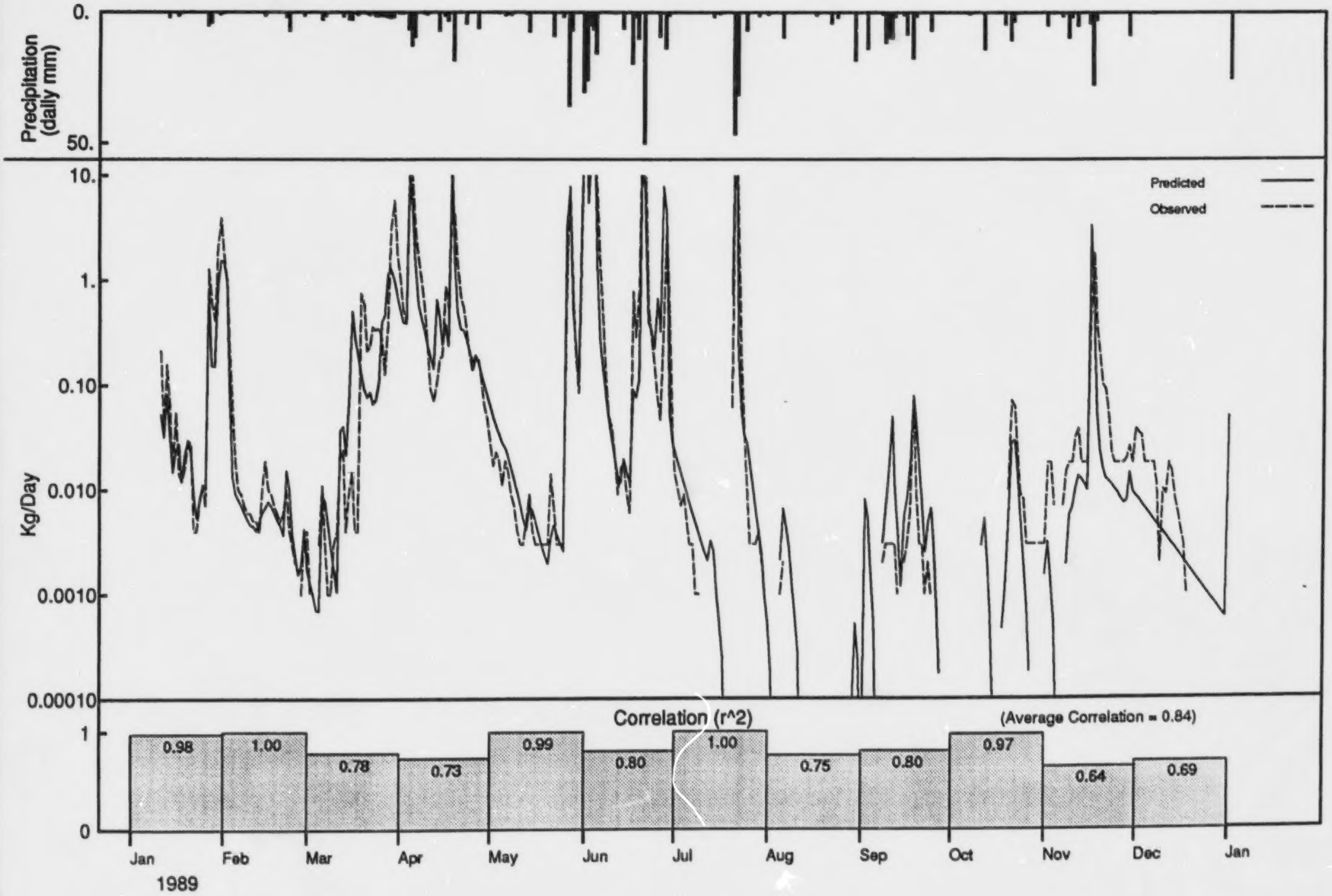


Figure 4.12: Essex Control Cumulative Phosphorus, 1989

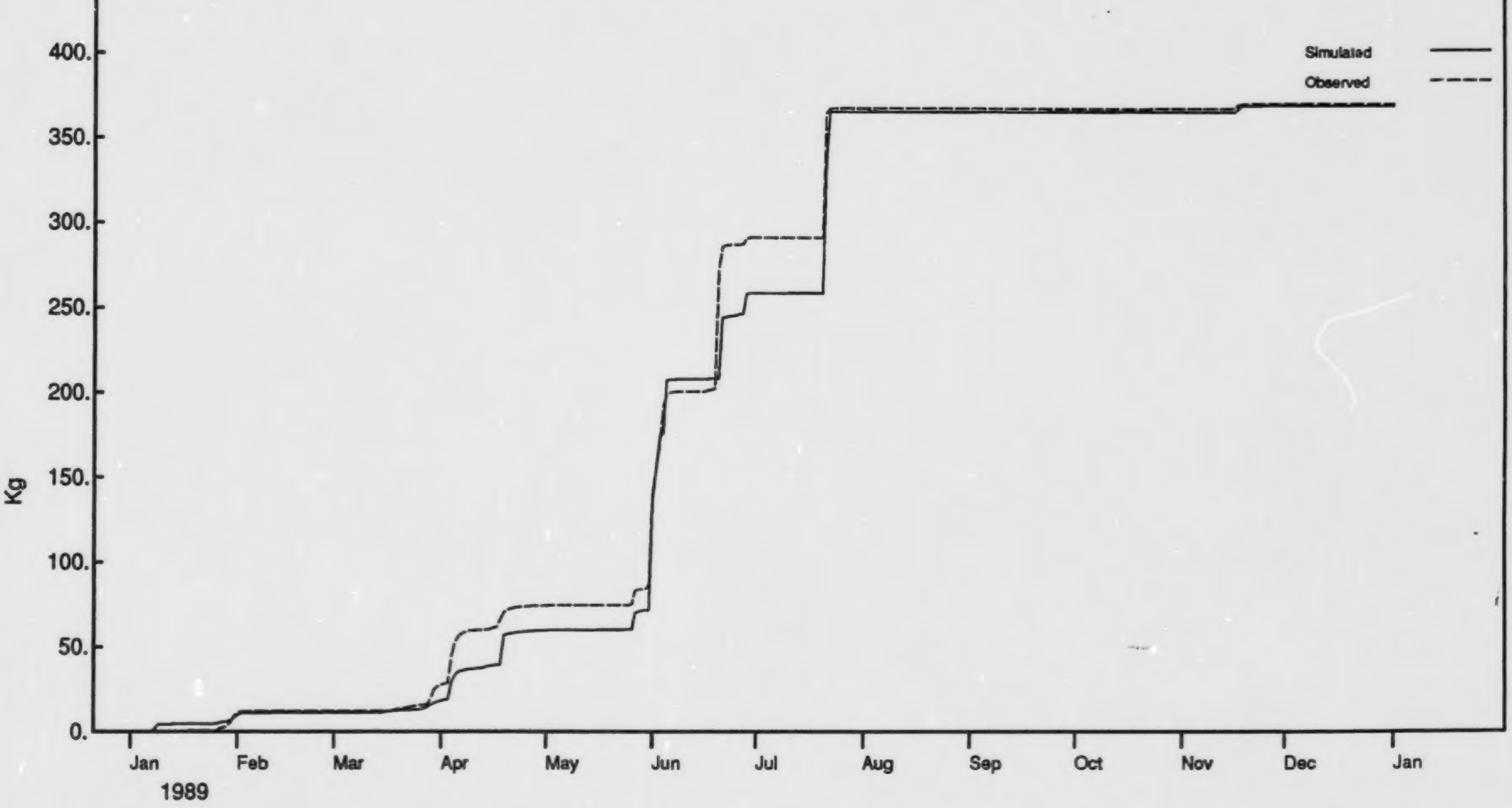
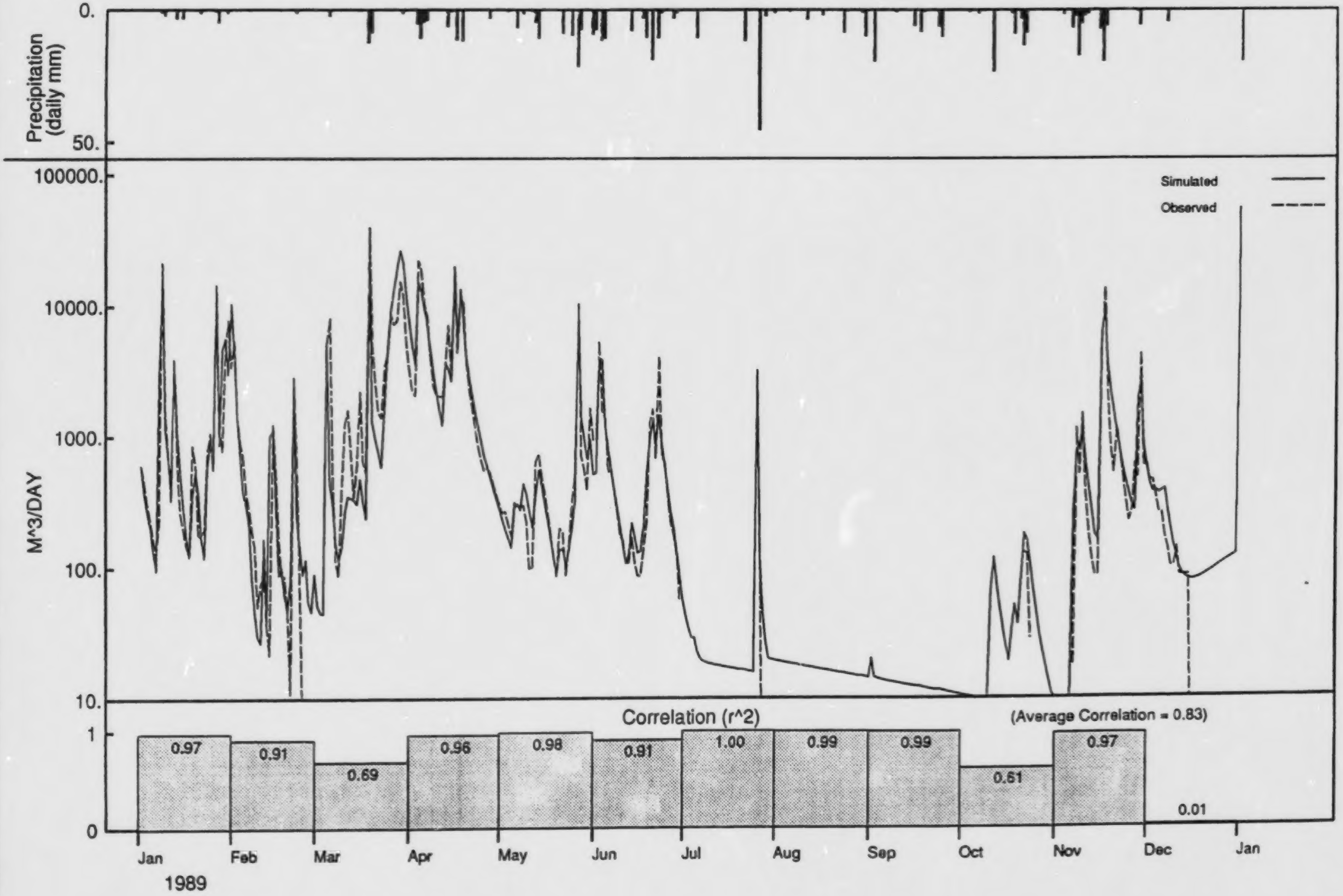


Figure 4.13: Kettle Creek Test Streamflow, 1989



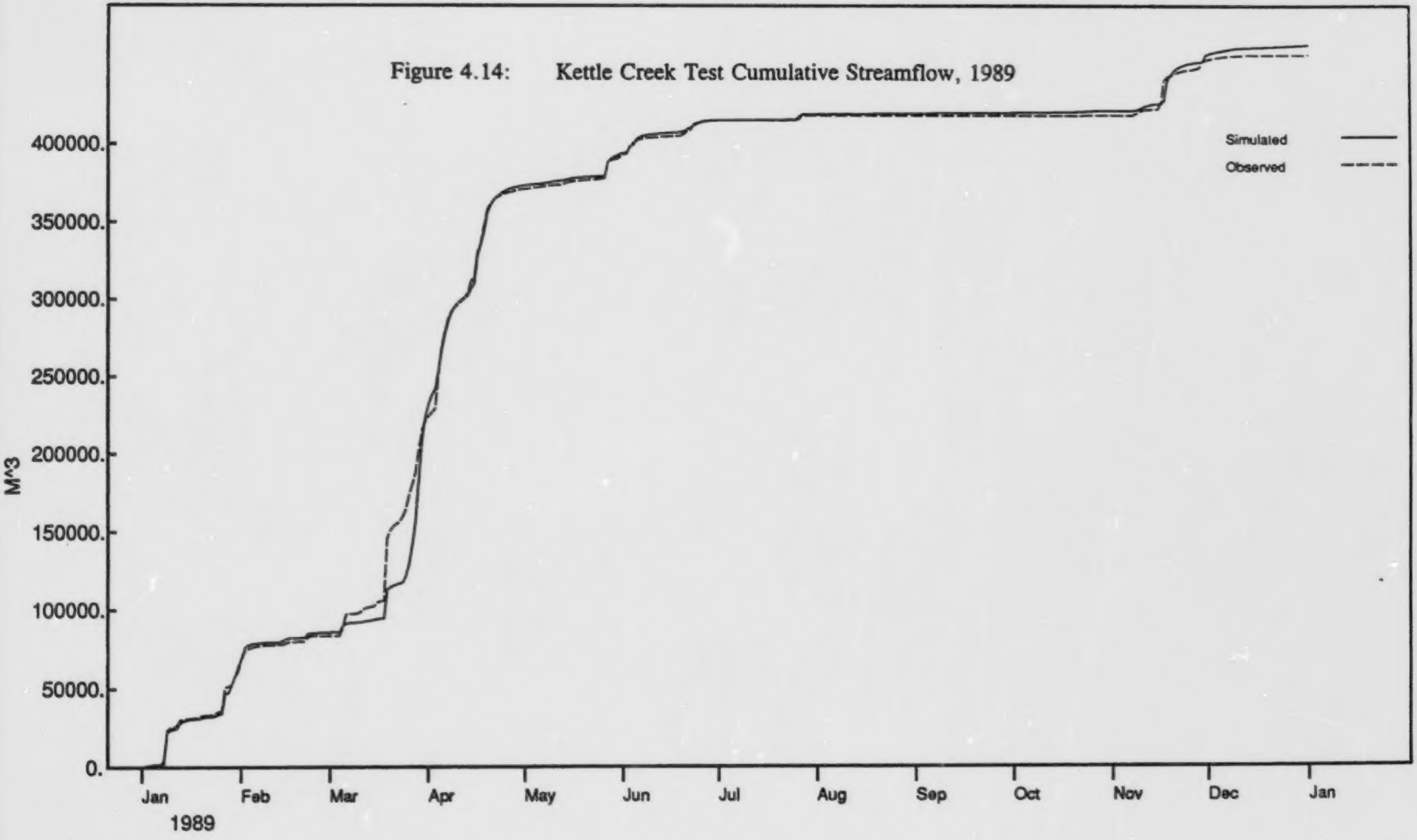
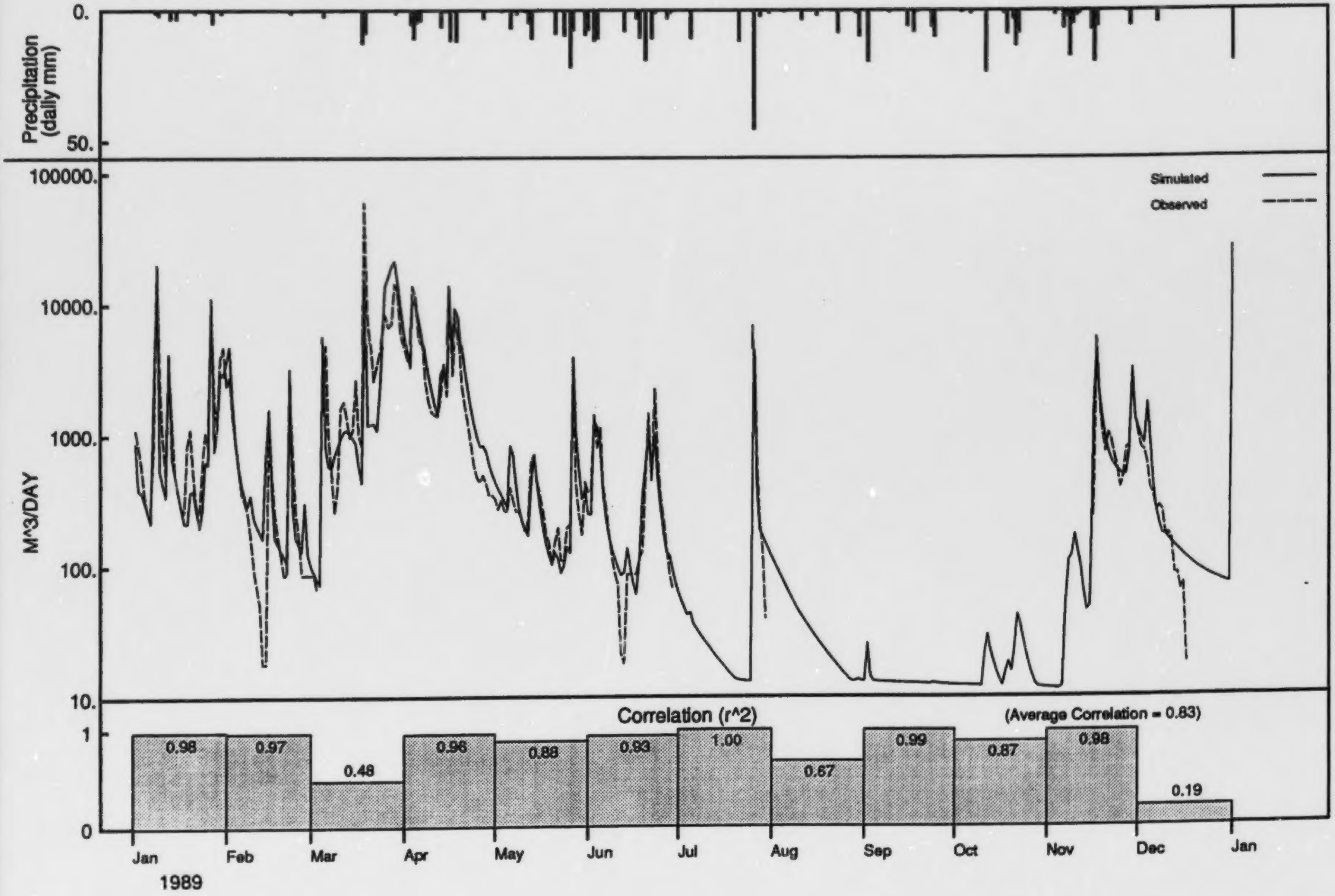


Figure 4.14: Kettle Creek Test Cumulative Streamflow, 1989

Figure 4.15: Kettle Creek Control Streamflow, 1989



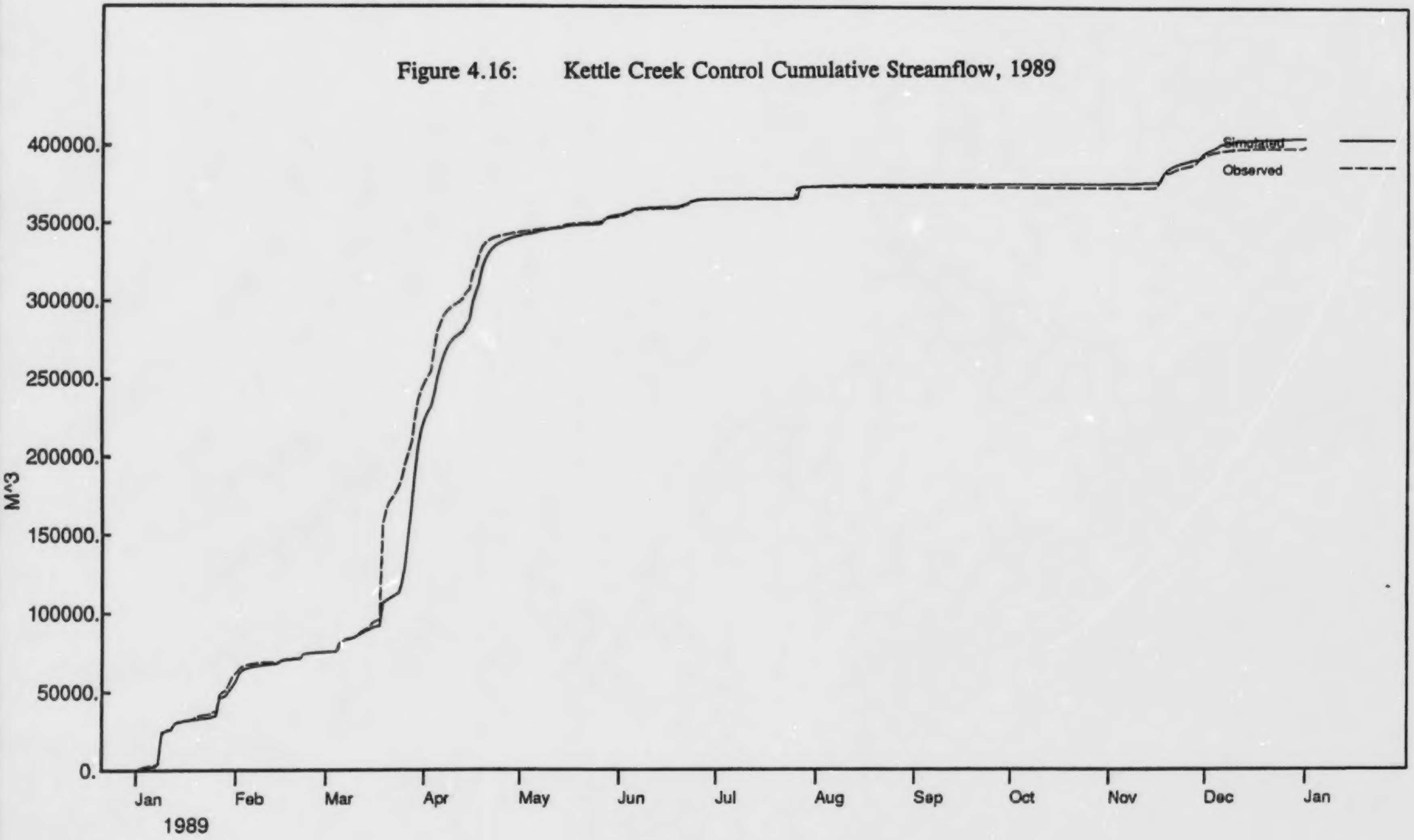


Figure 4.16: Kettle Creek Control Cumulative Streamflow, 1989

Figure 4.17: Kettle Creek Test Soil Loss, 1989

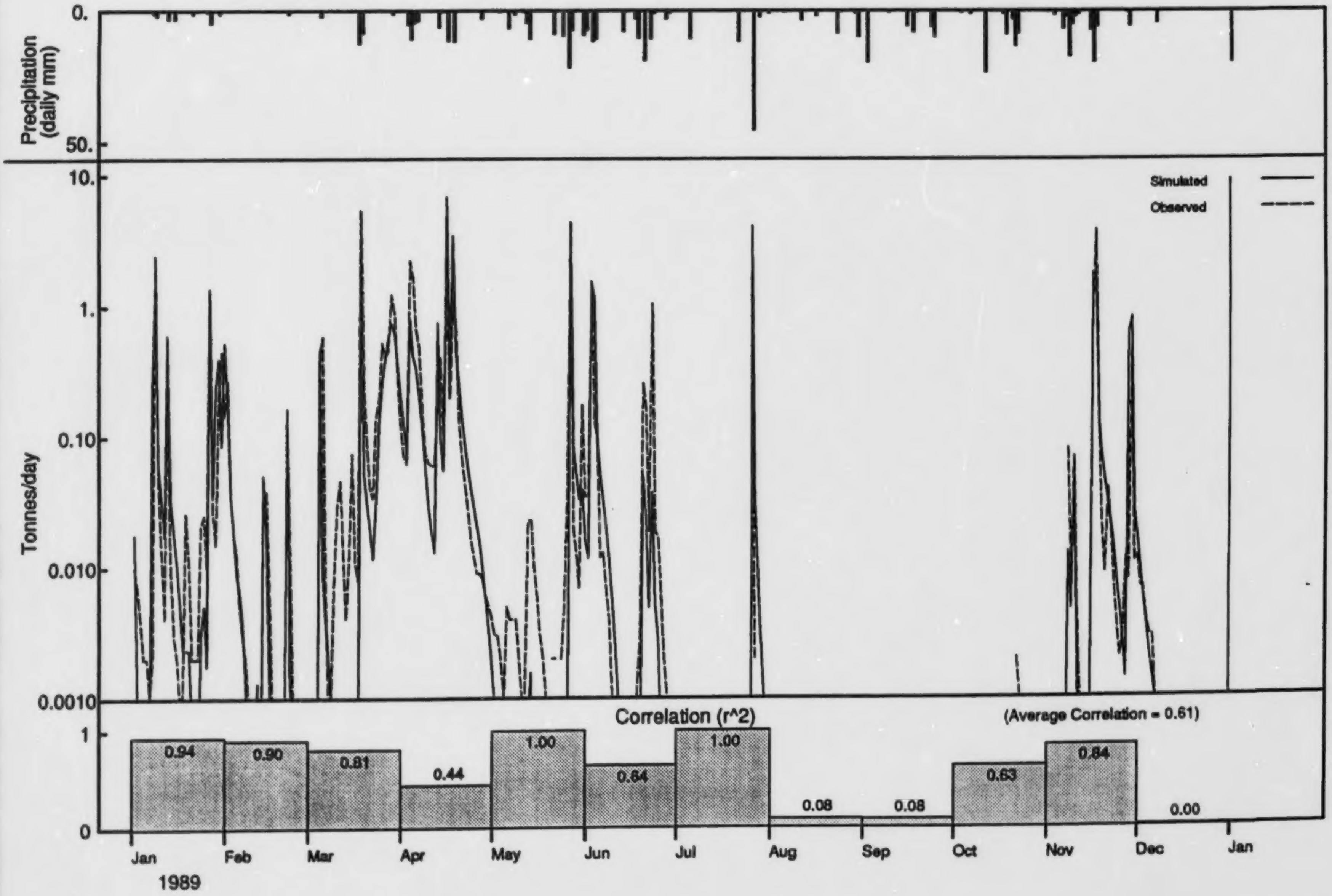


Figure 4.18: Kettle Creek Test Cumulative Soil Loss, 1989

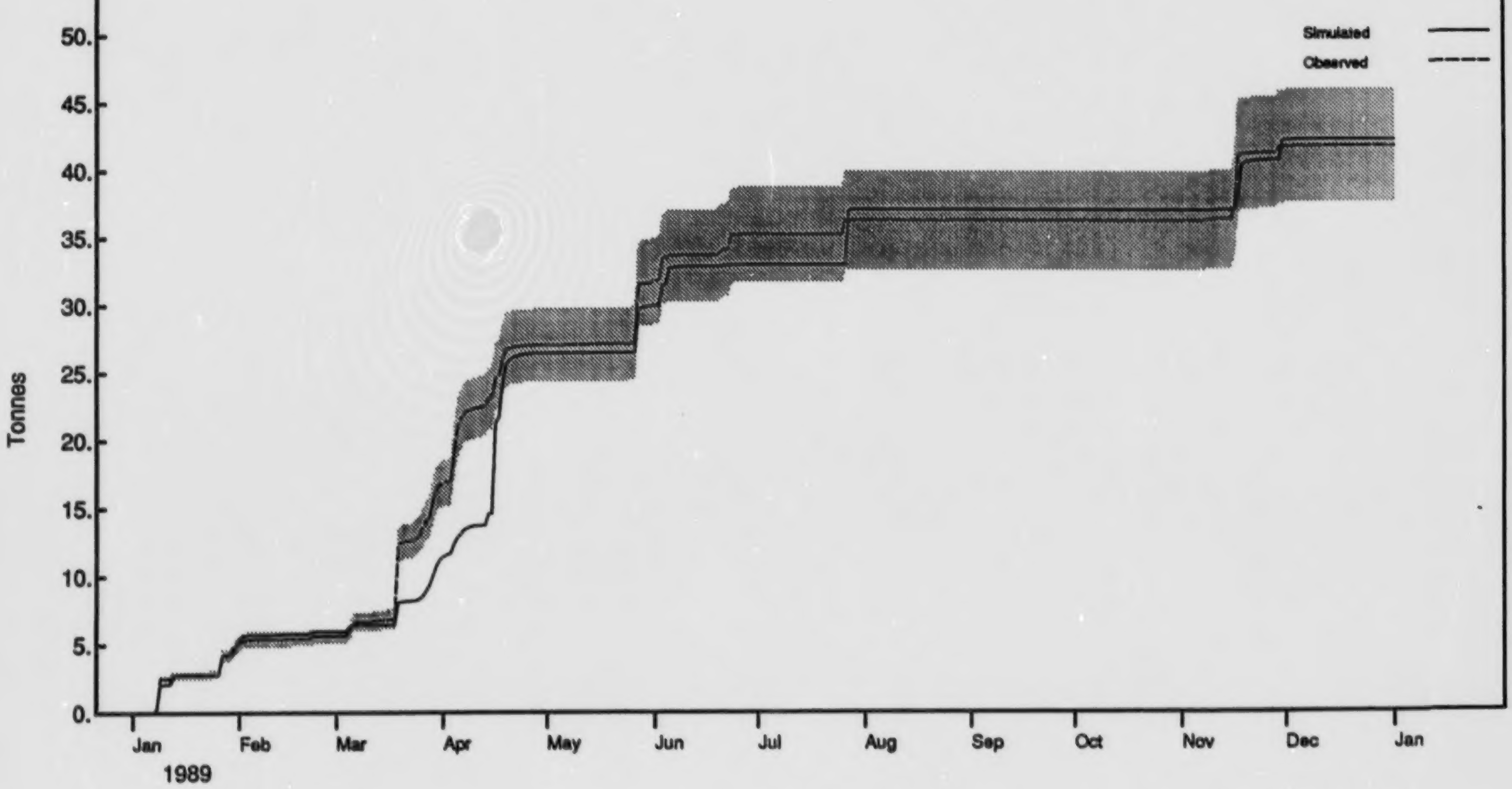
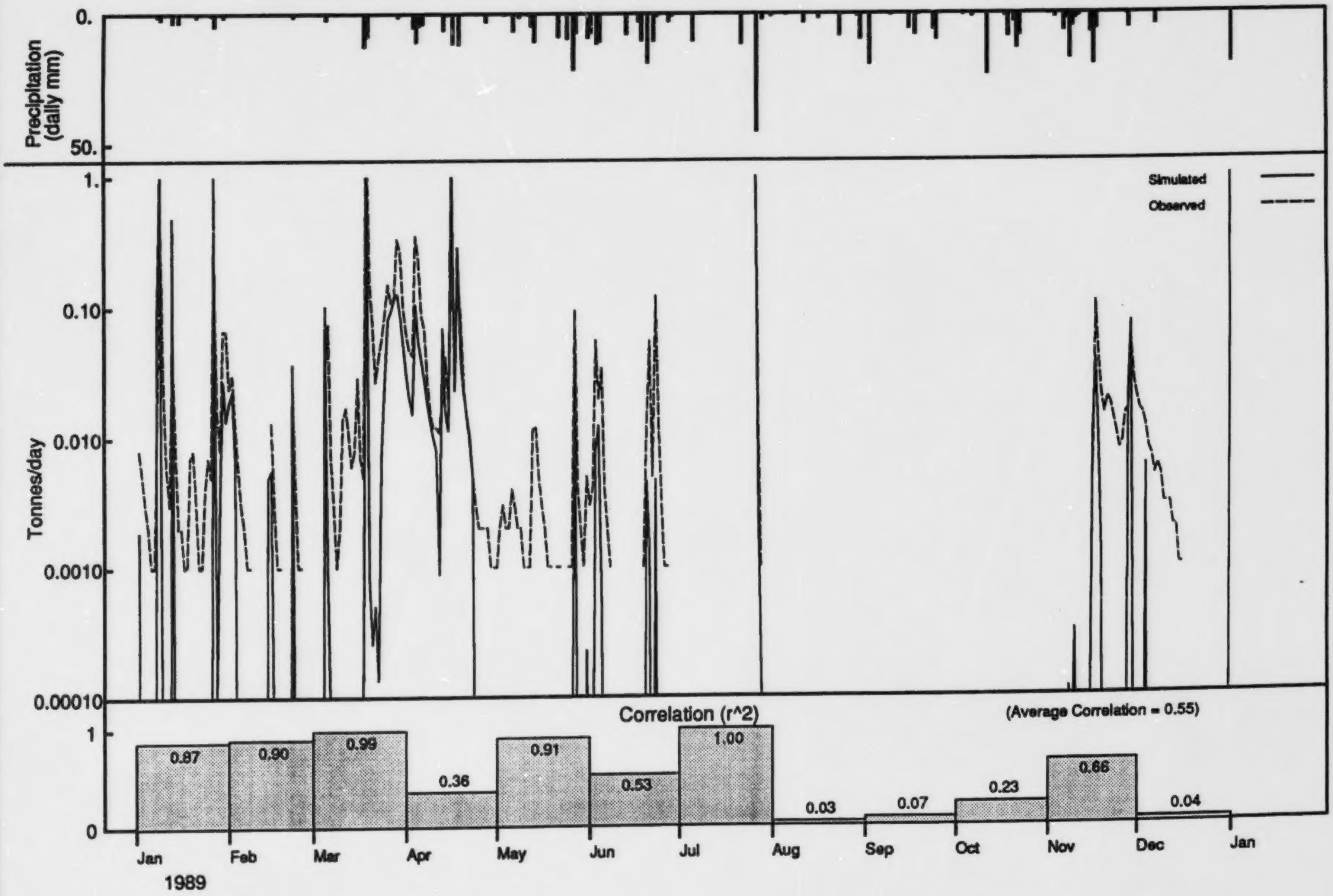


Figure 4.19: Kettle Creek Control Soil Loss, 1989



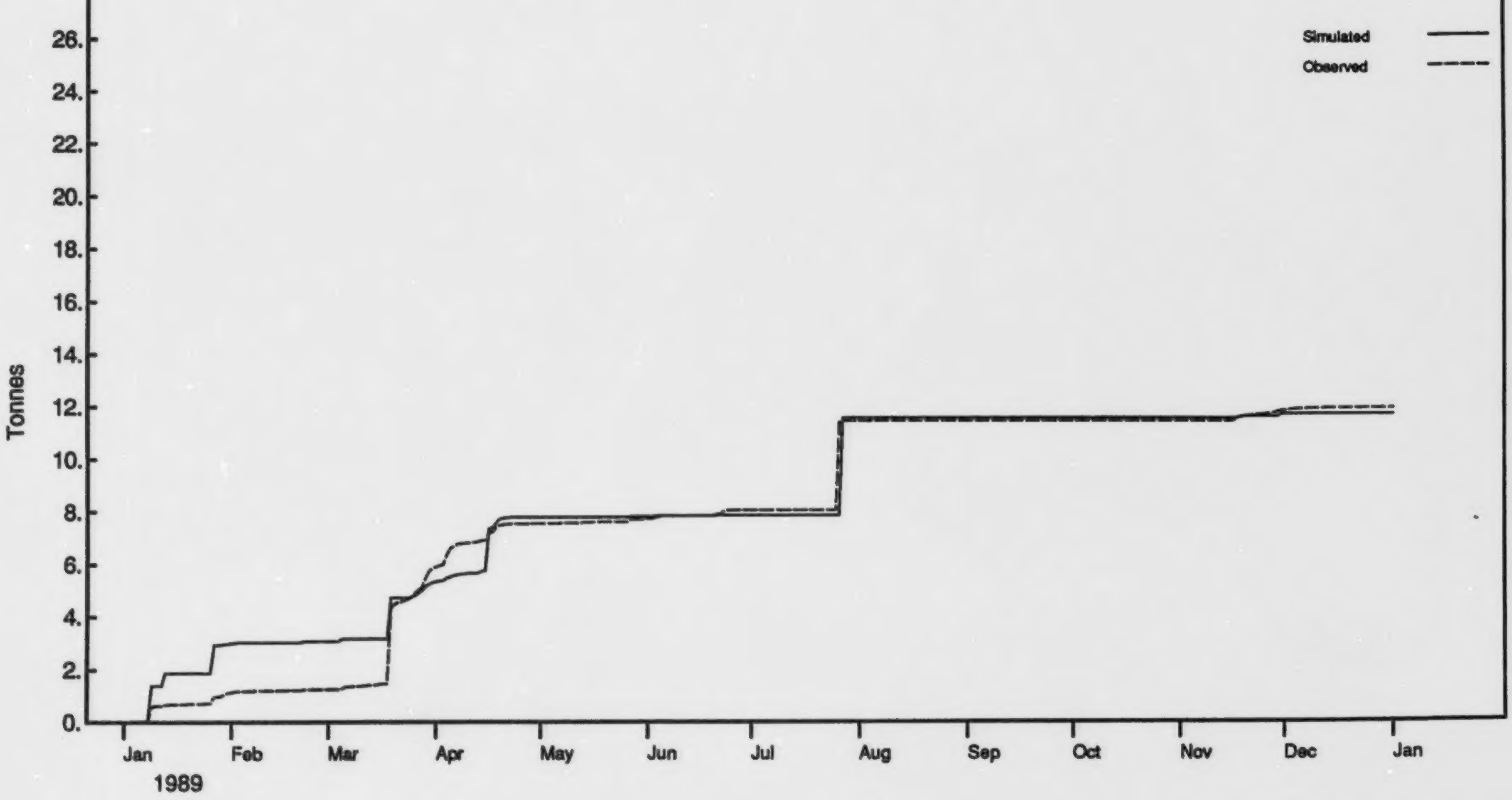
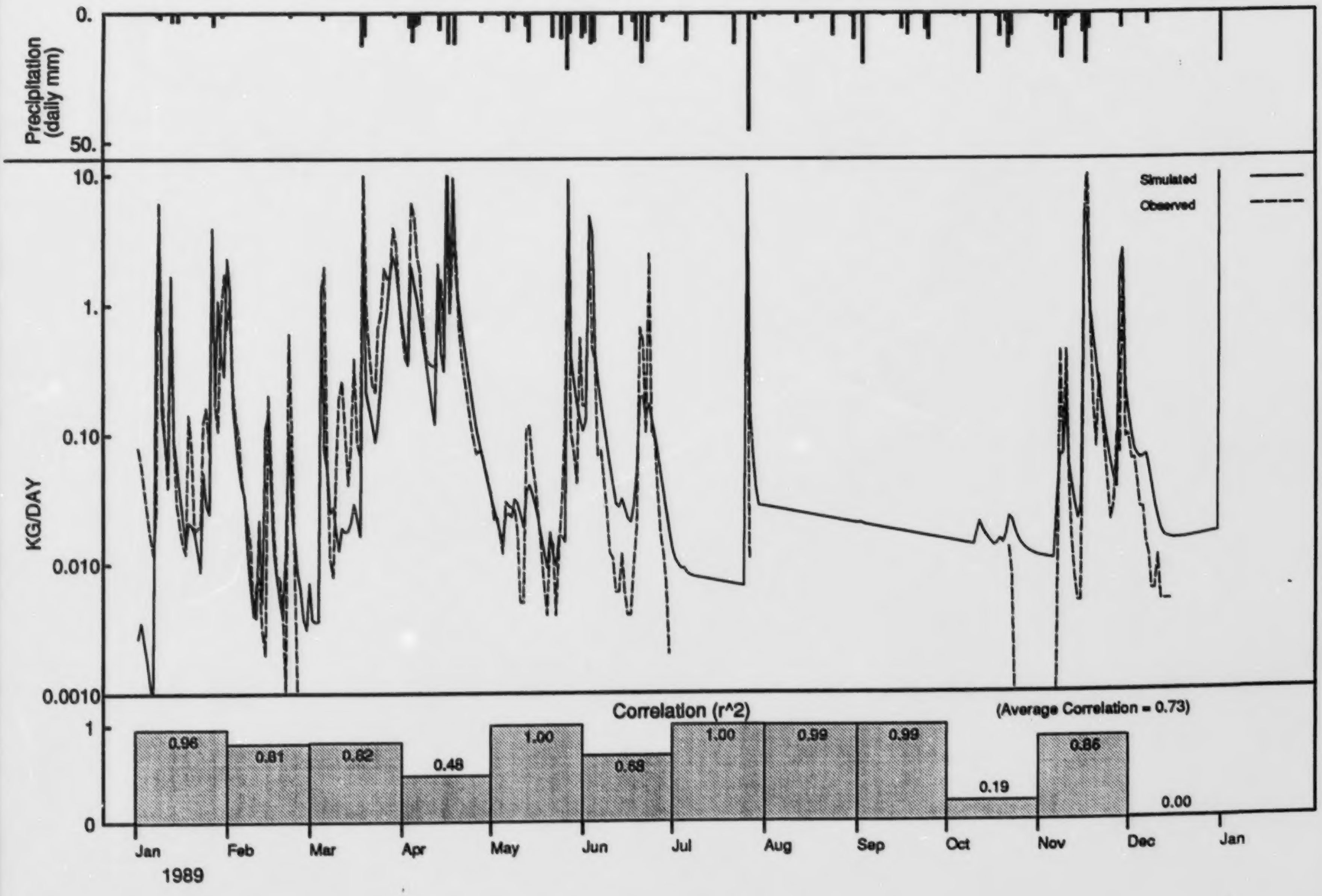


Figure 4.20: Kettle Creek Control Cumulative Soil Loss, 1989

Figure 4.21: Kettle Creek Test Phosphorus Loss, 1989



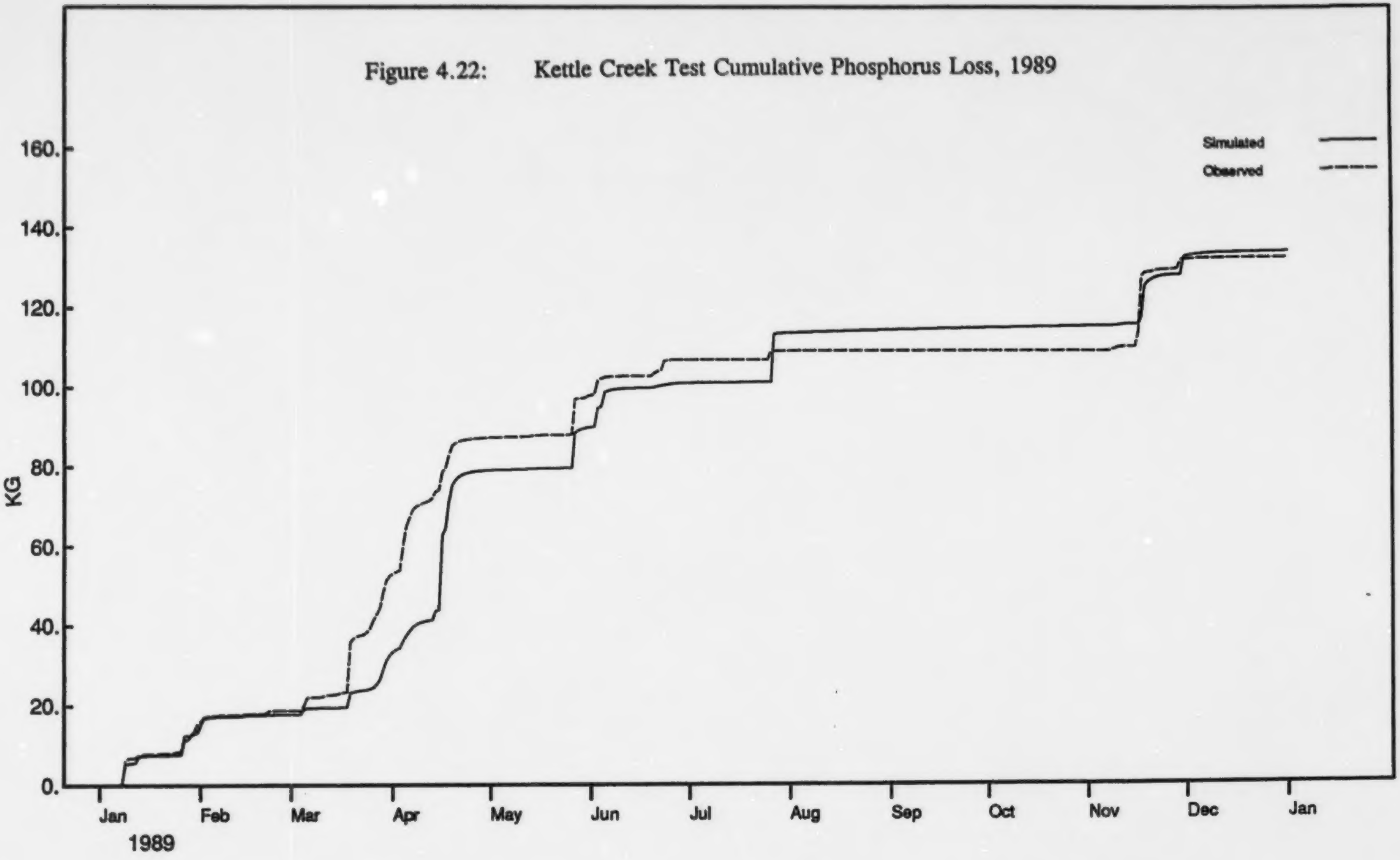


Figure 4.22: Kettle Creek Test Cumulative Phosphorus Loss, 1989

Figure 4.23: Kettle Creek Control Phosphorus Loss, 1989

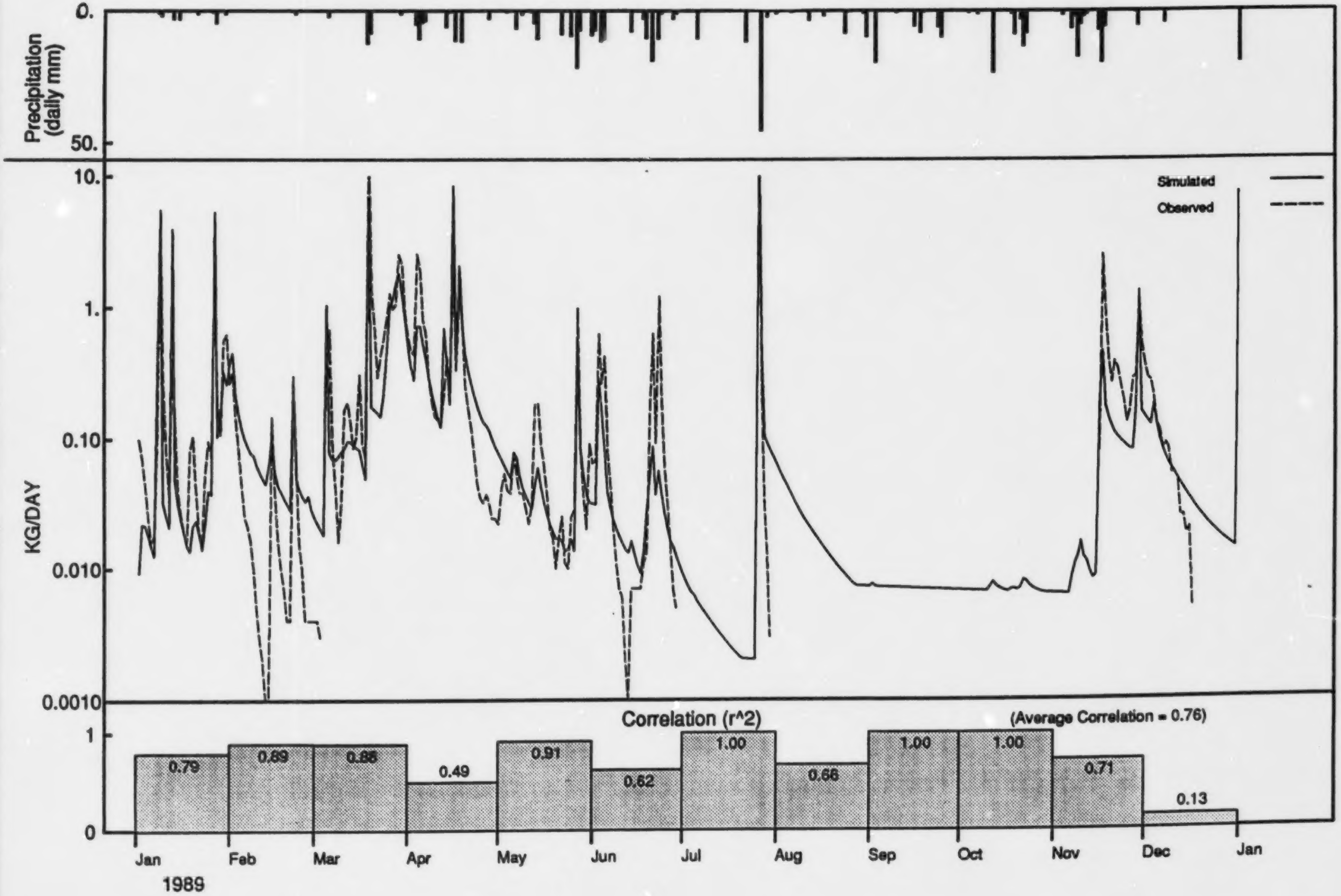


Figure 4.24: Kettle Creek Control Cumulative Phosphorus, 1989

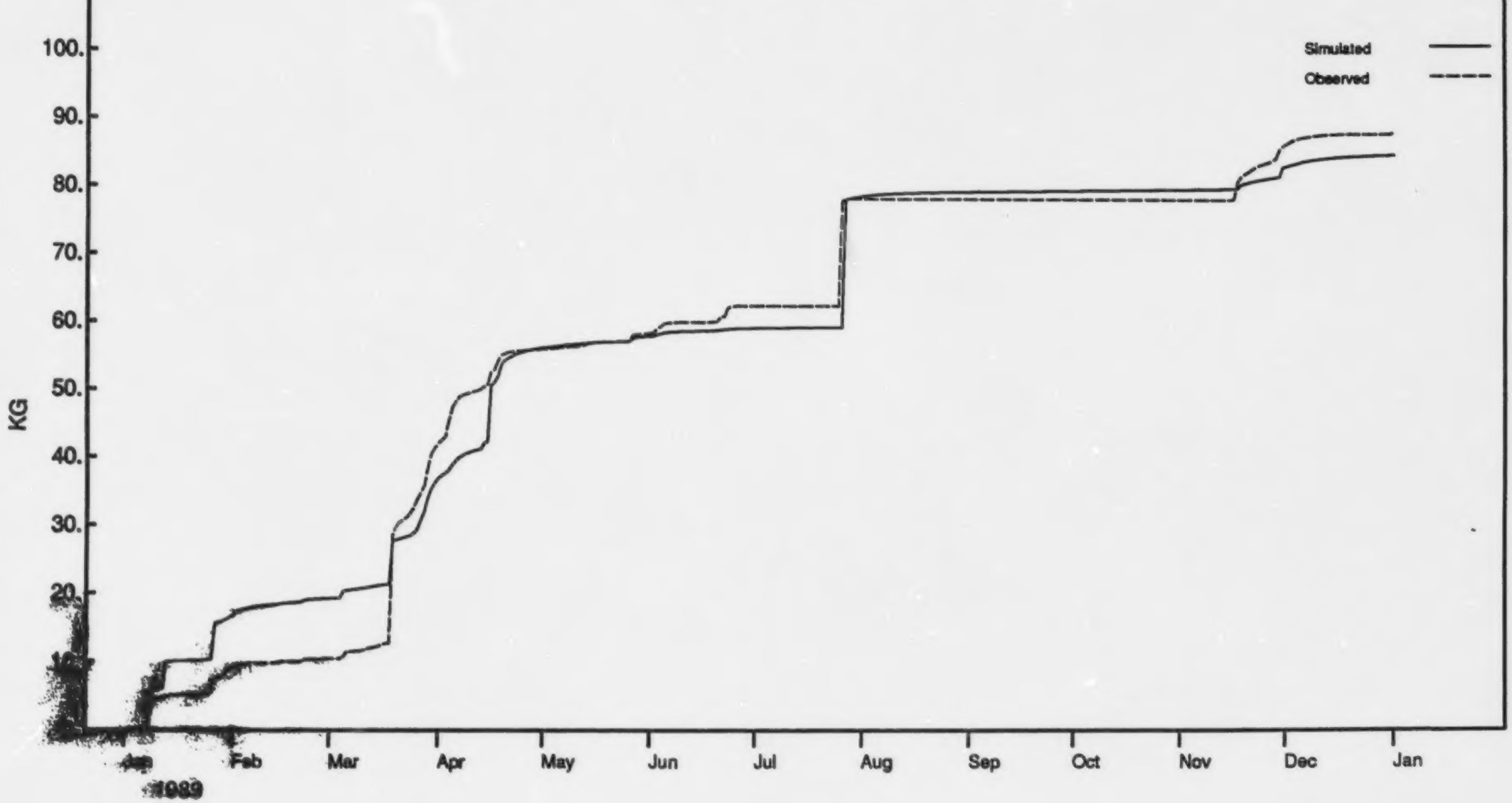


Figure 4.25: Pittock Test Streamflow, 1989

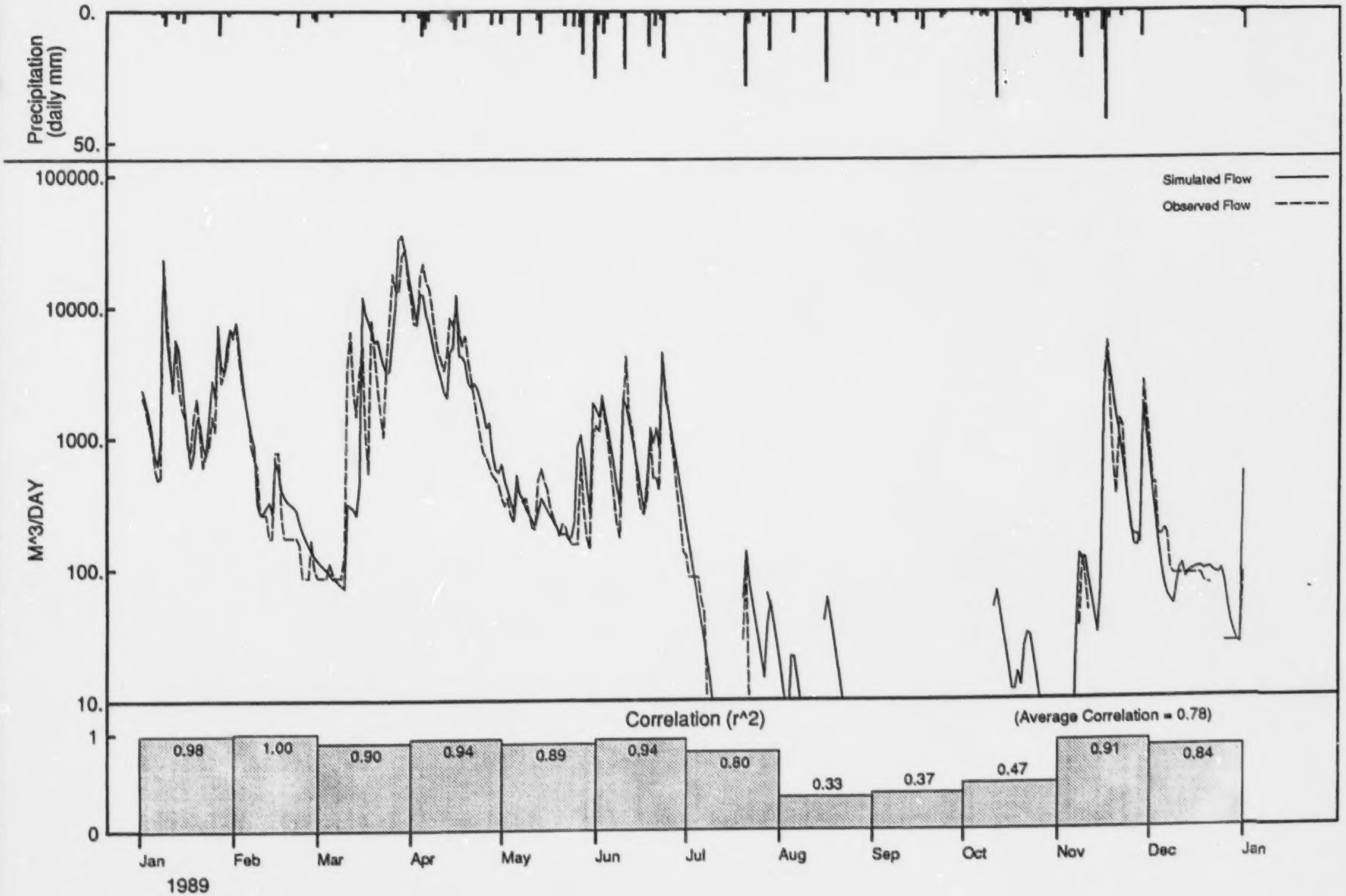


Figure 4.26: Pittock Test Cumulative Streamflow, 1989

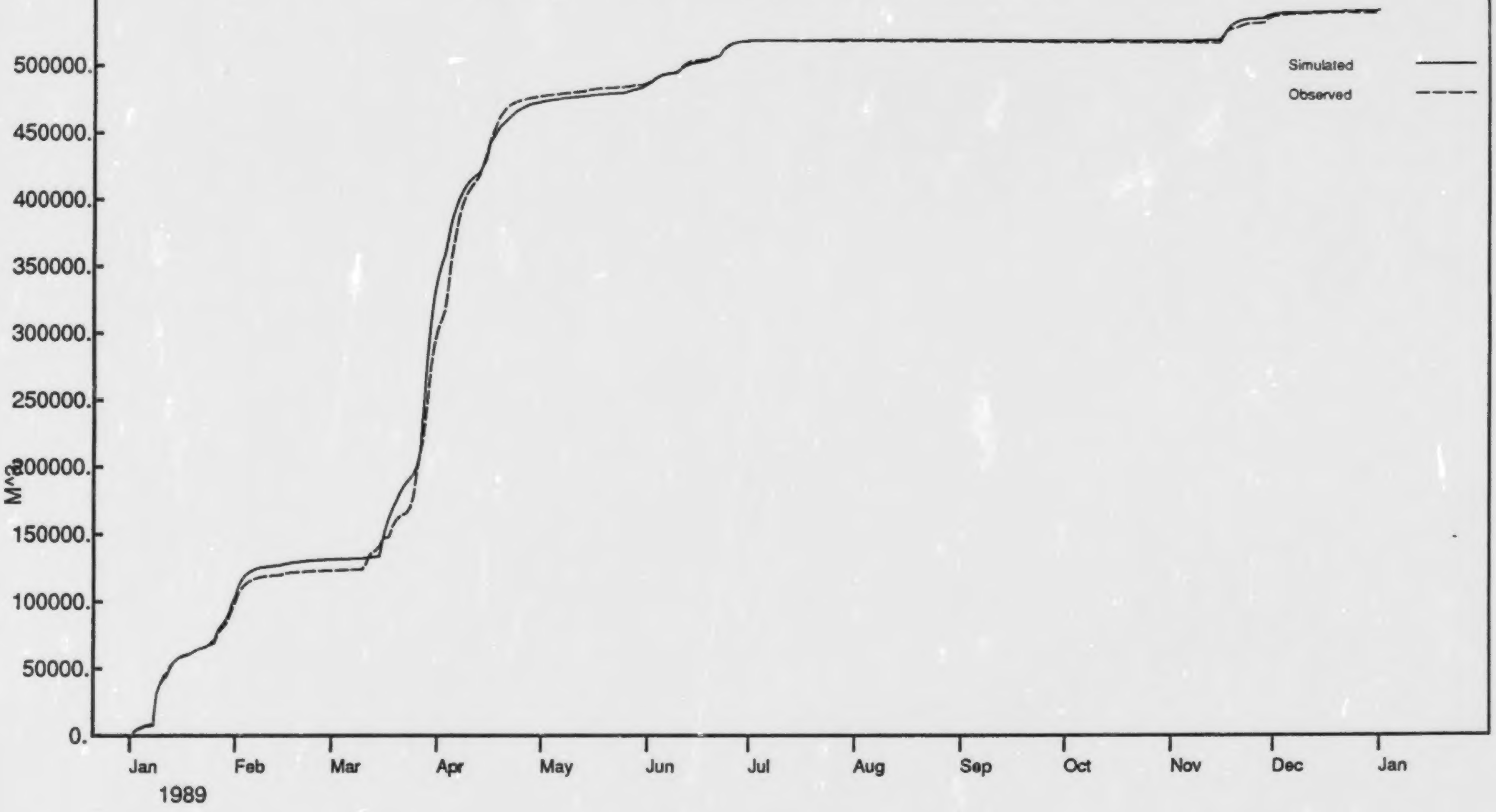
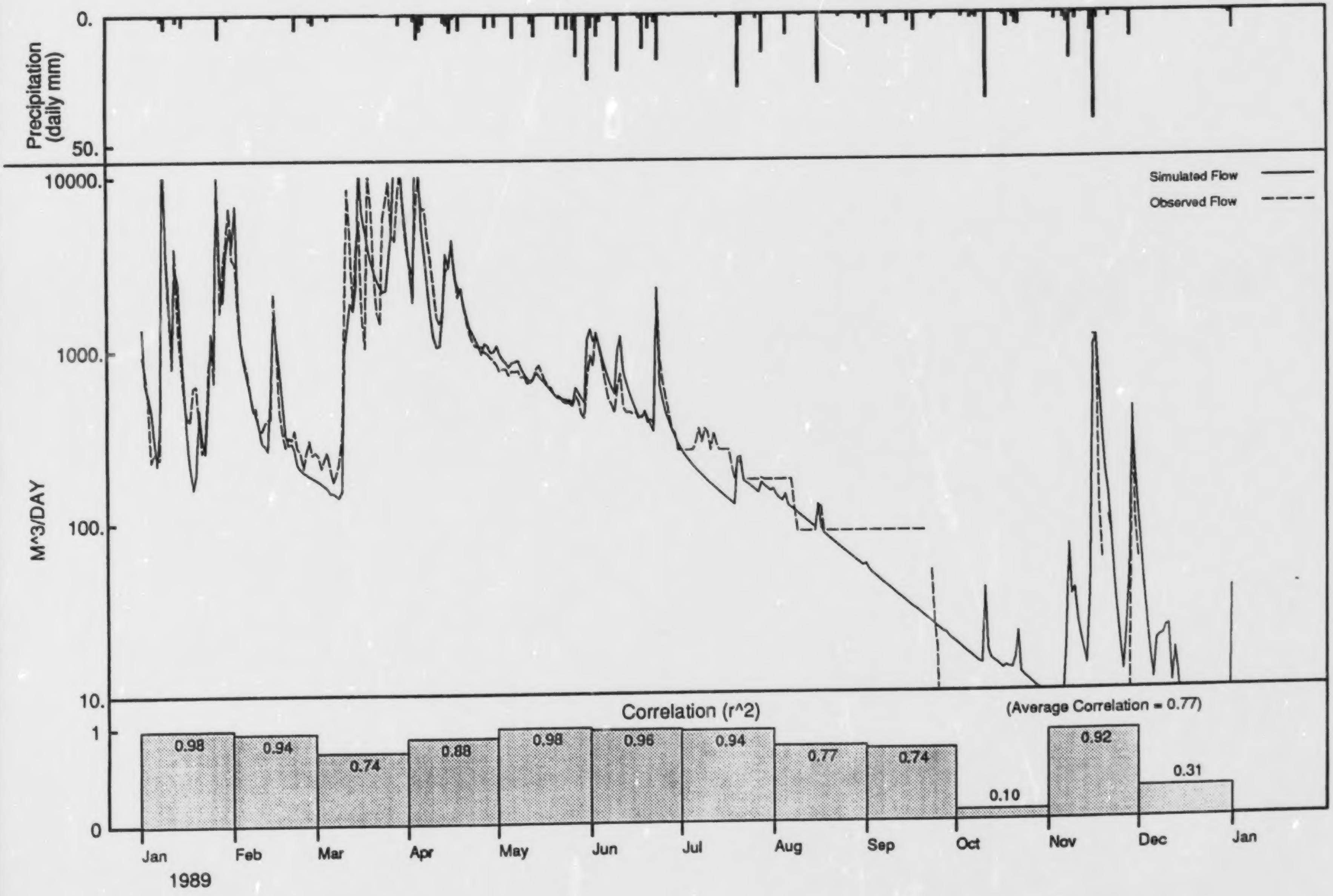


Figure 4.27: Pittock Control Streamflow, 1989



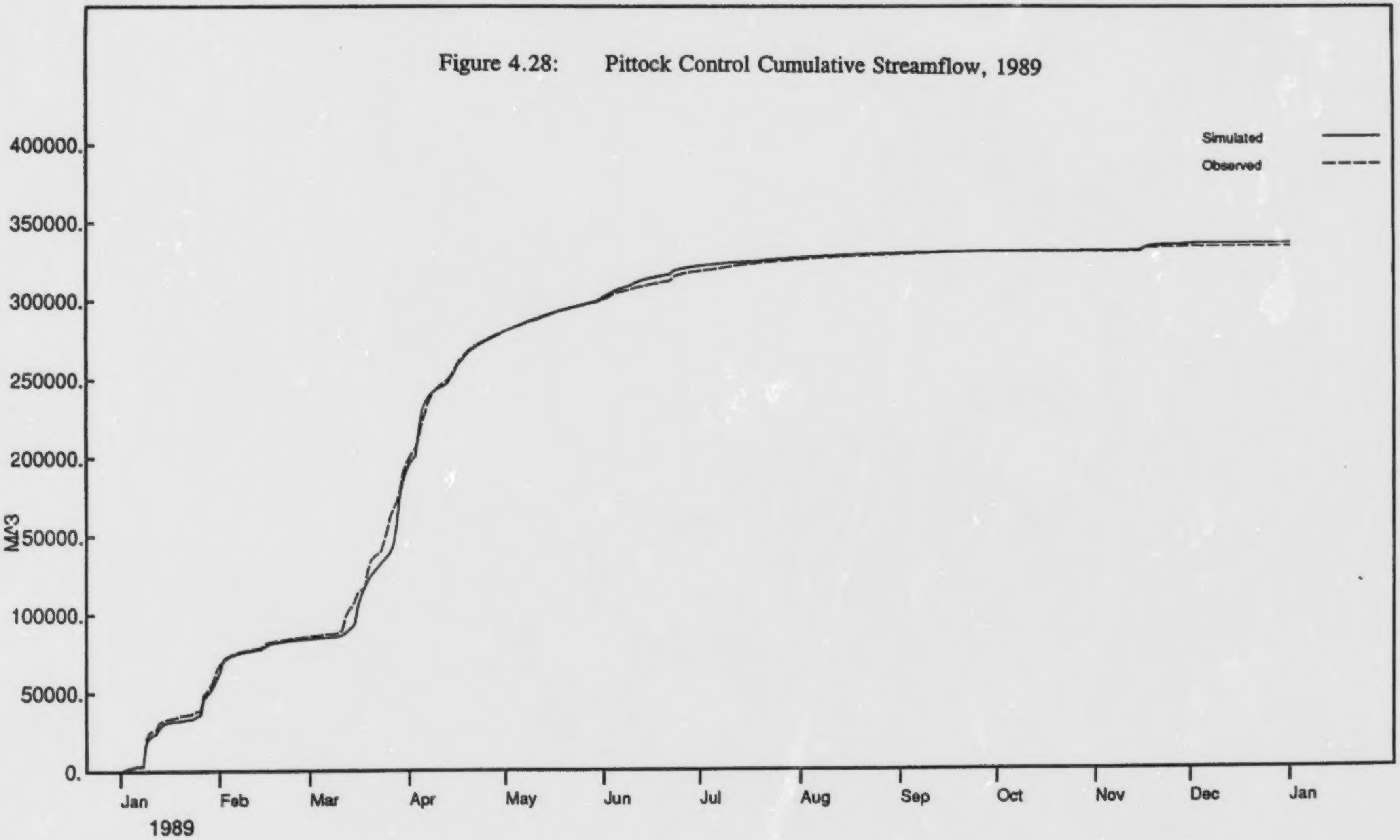


Figure 4.28: Pittock Control Cumulative Streamflow, 1989

Figure 4.29: Pittock Test Soil Loss, 1989

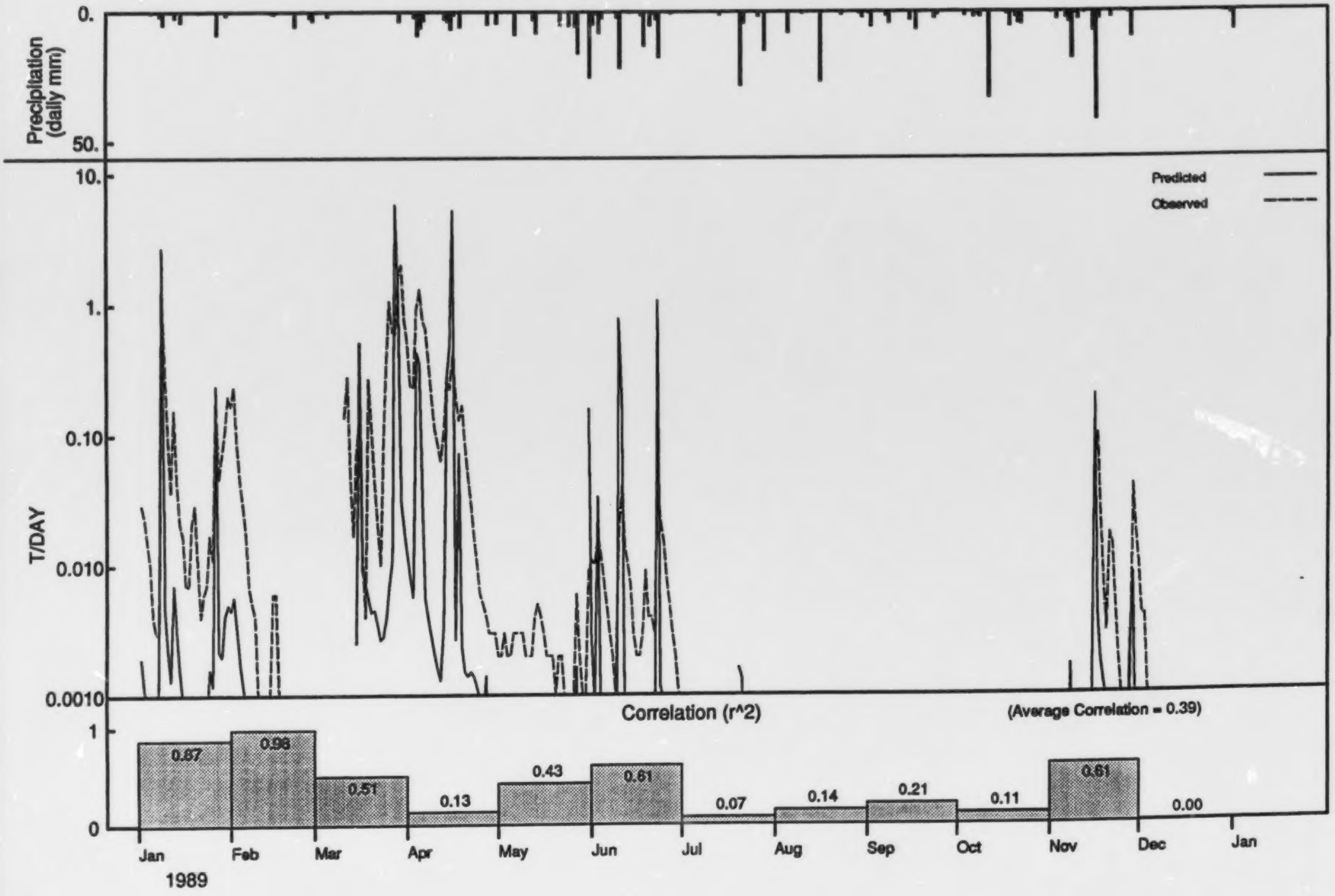


Figure 4.30: Pittock Test Cumulative Soil Loss, 1989

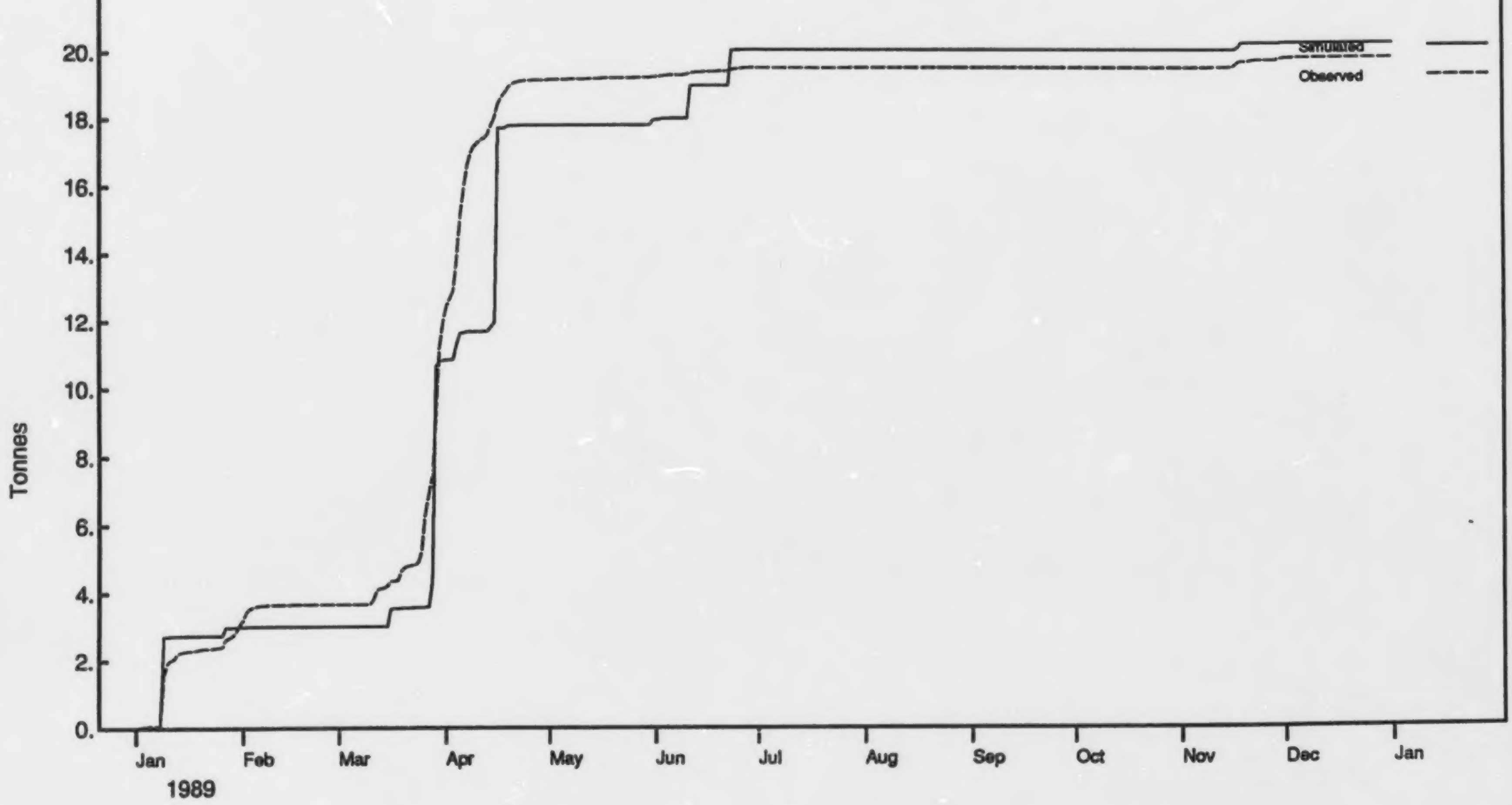


Figure 4.31: Pittock Control Soil Loss, 1989

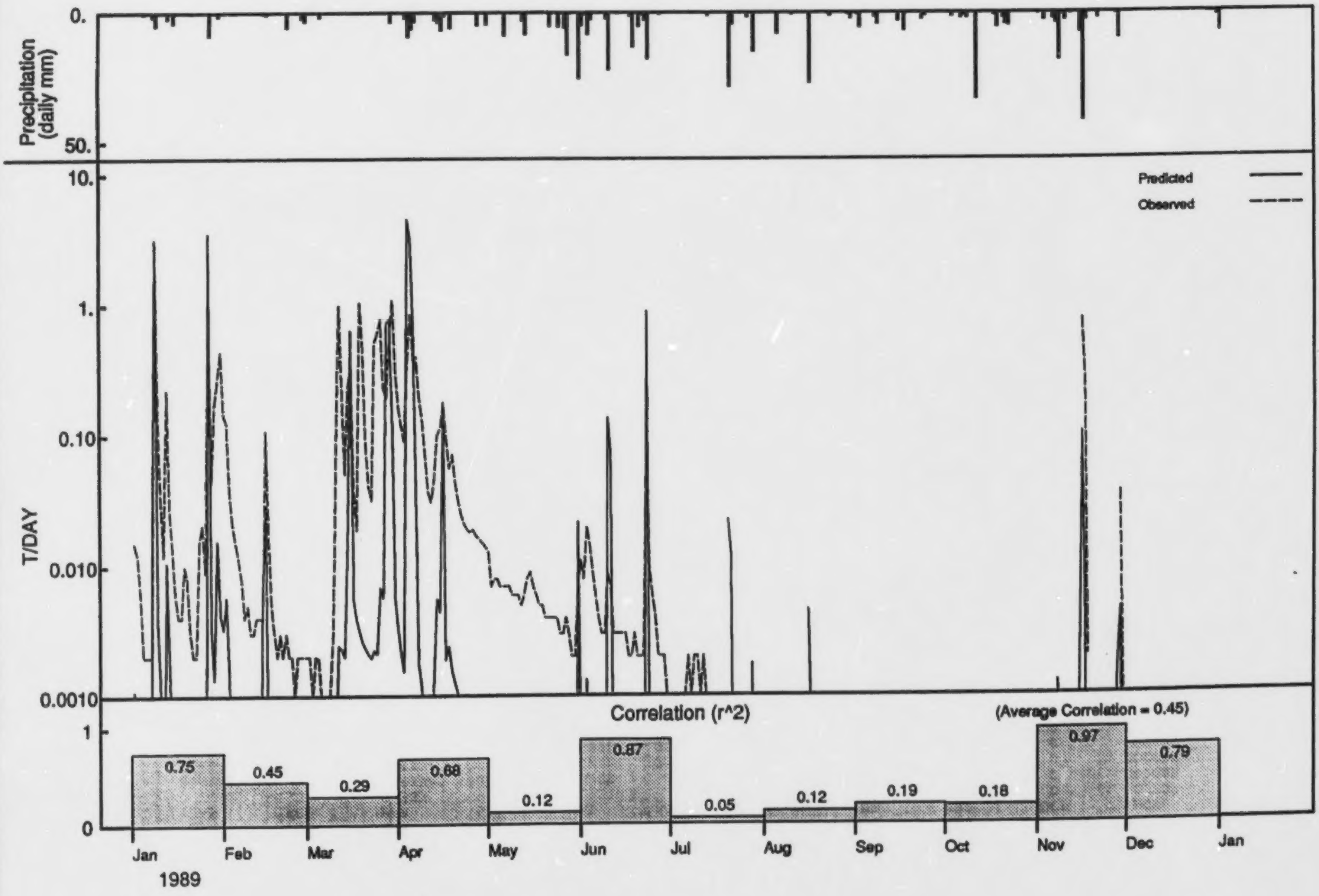


Figure 4.32: Pittock Control Cumulative Soil Loss, 1989

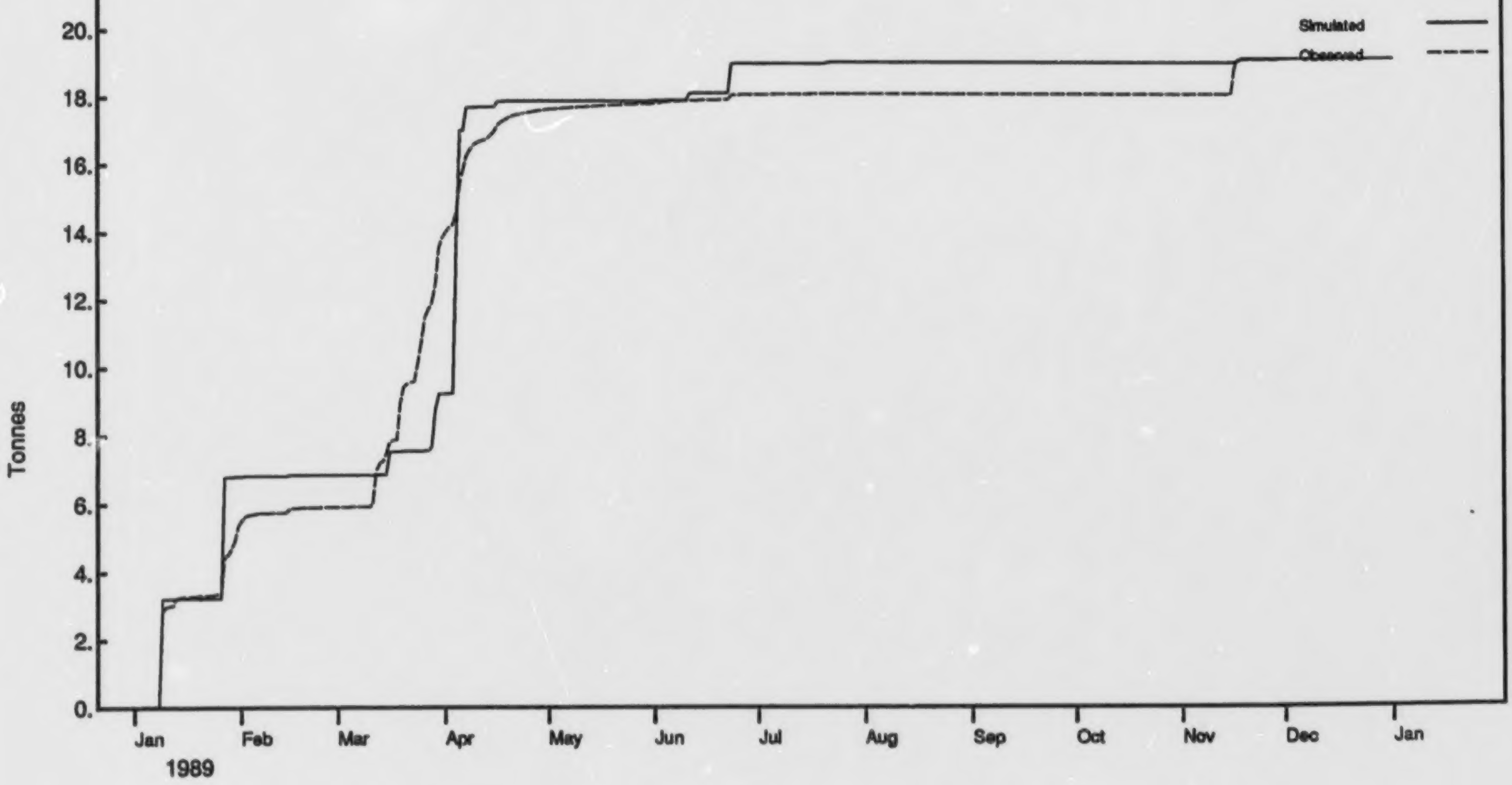


Figure 4.33: Pittock Test Phosphorus Loss, 1989

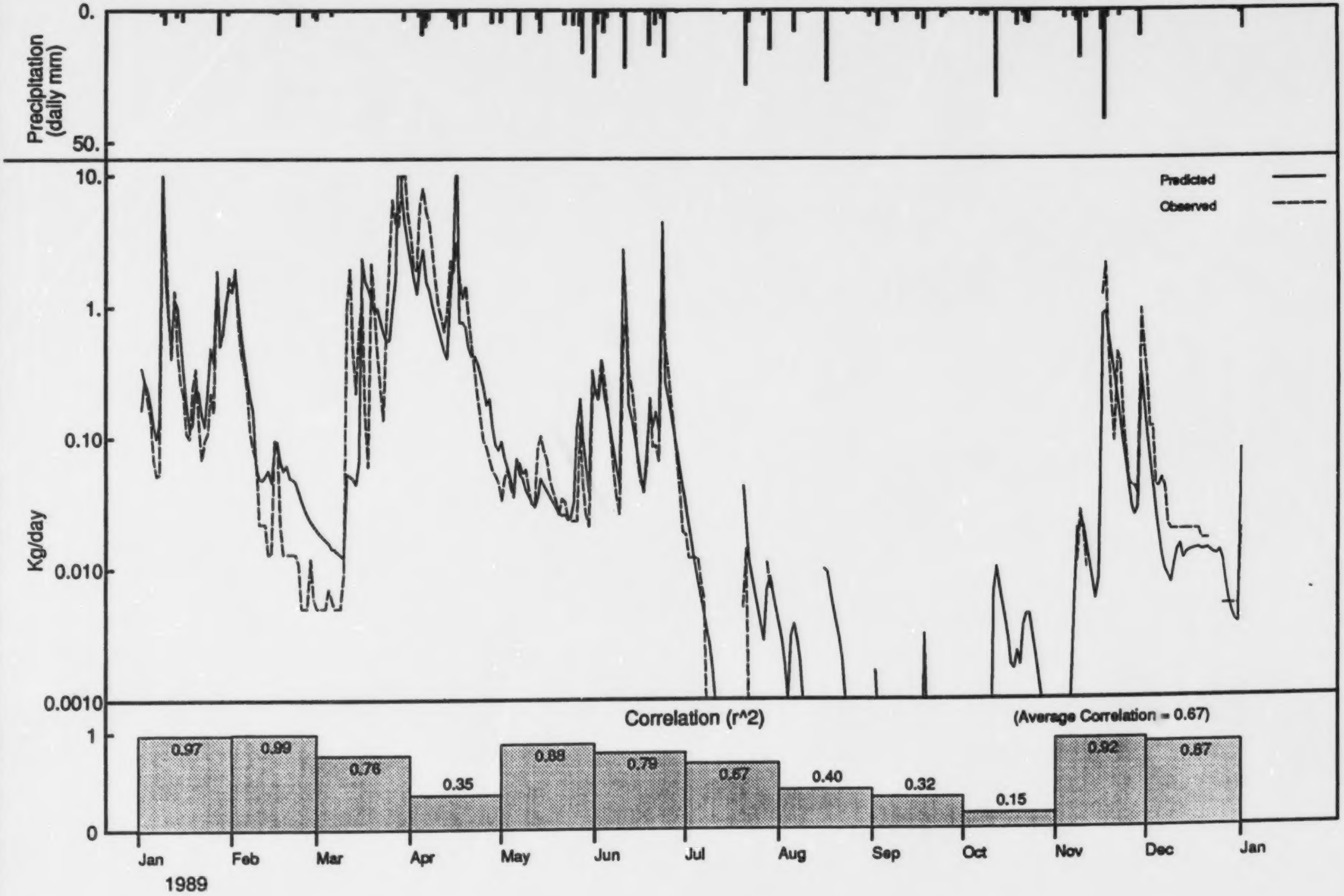


Figure 4.34: Pittock Test Cumulative Phosphorus Loss, 1989

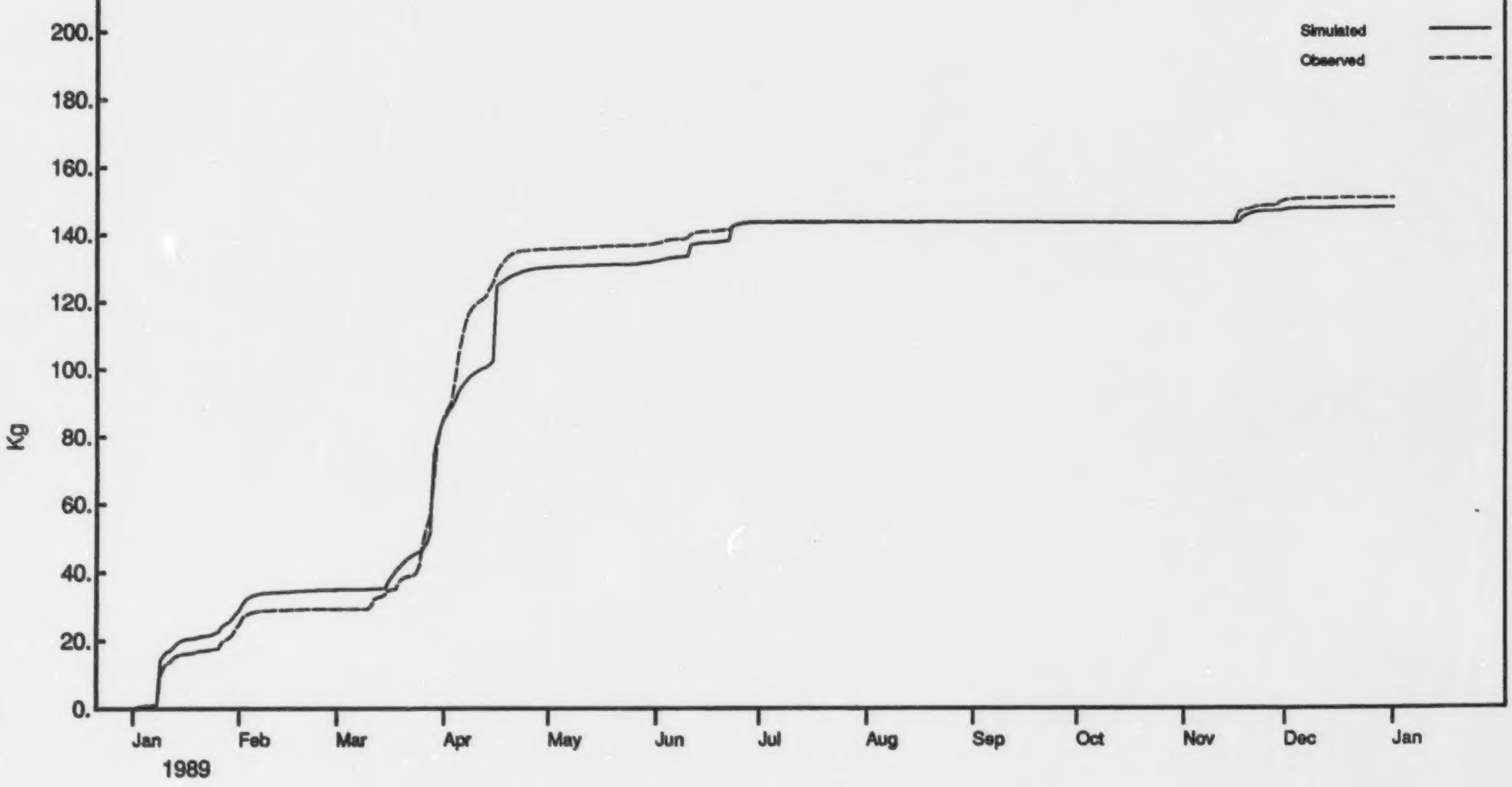


Figure 4.35: Pittock Control Phosphorus Loss, 1989

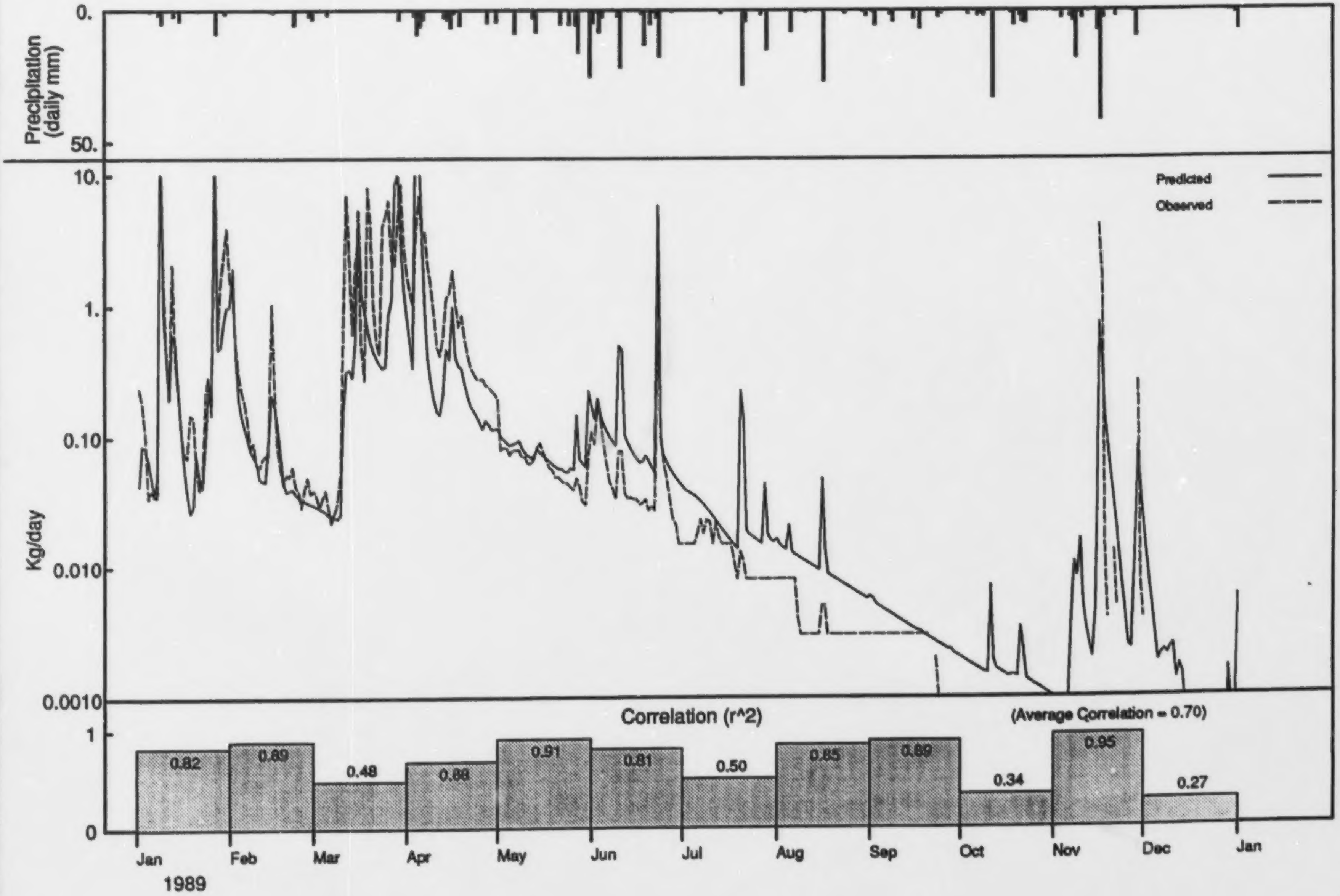


Figure 4.36: Pittock Control Cumulative Phosphorus, 1989

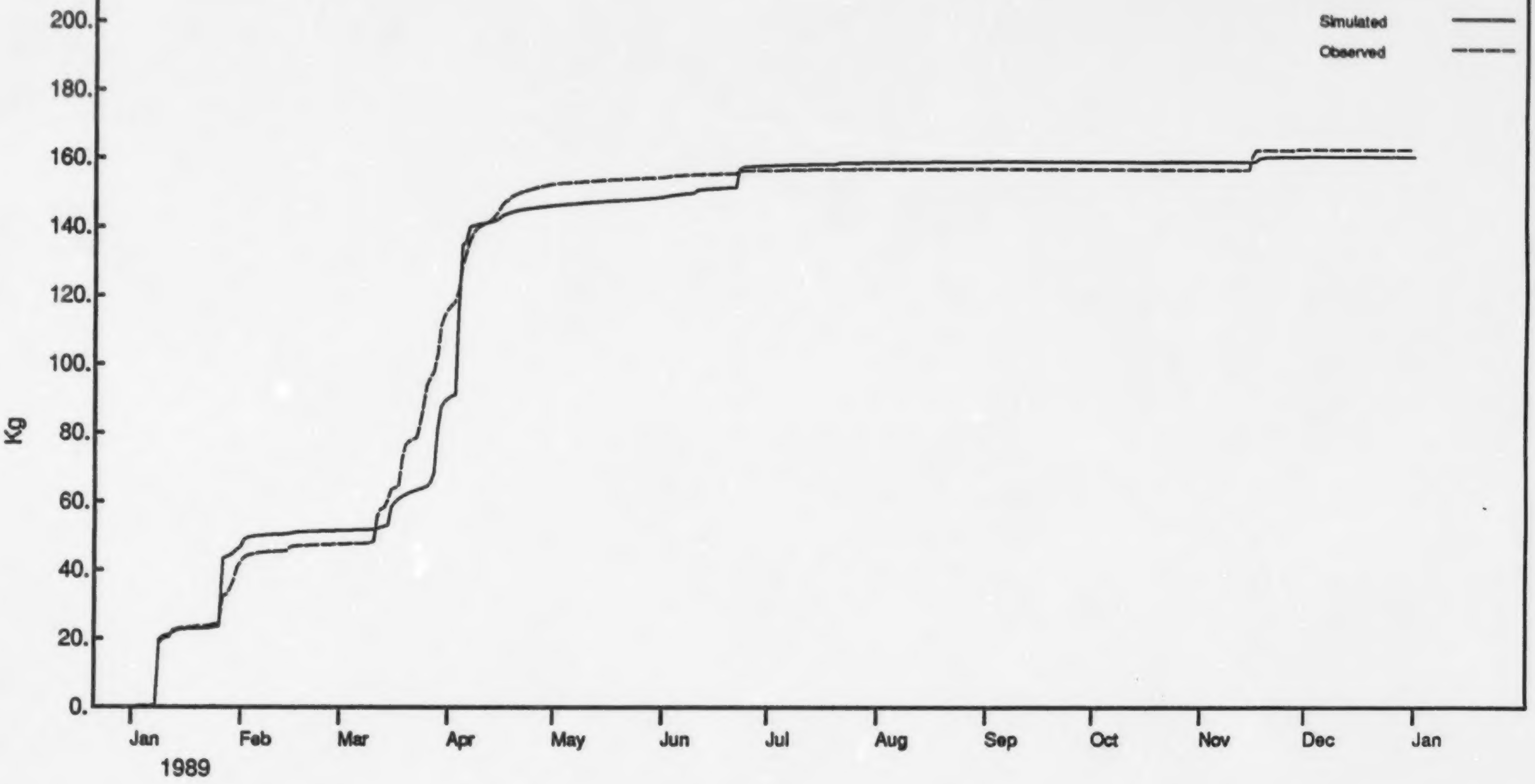


Figure 4.37: Essex Test Streamflow, 1989-90

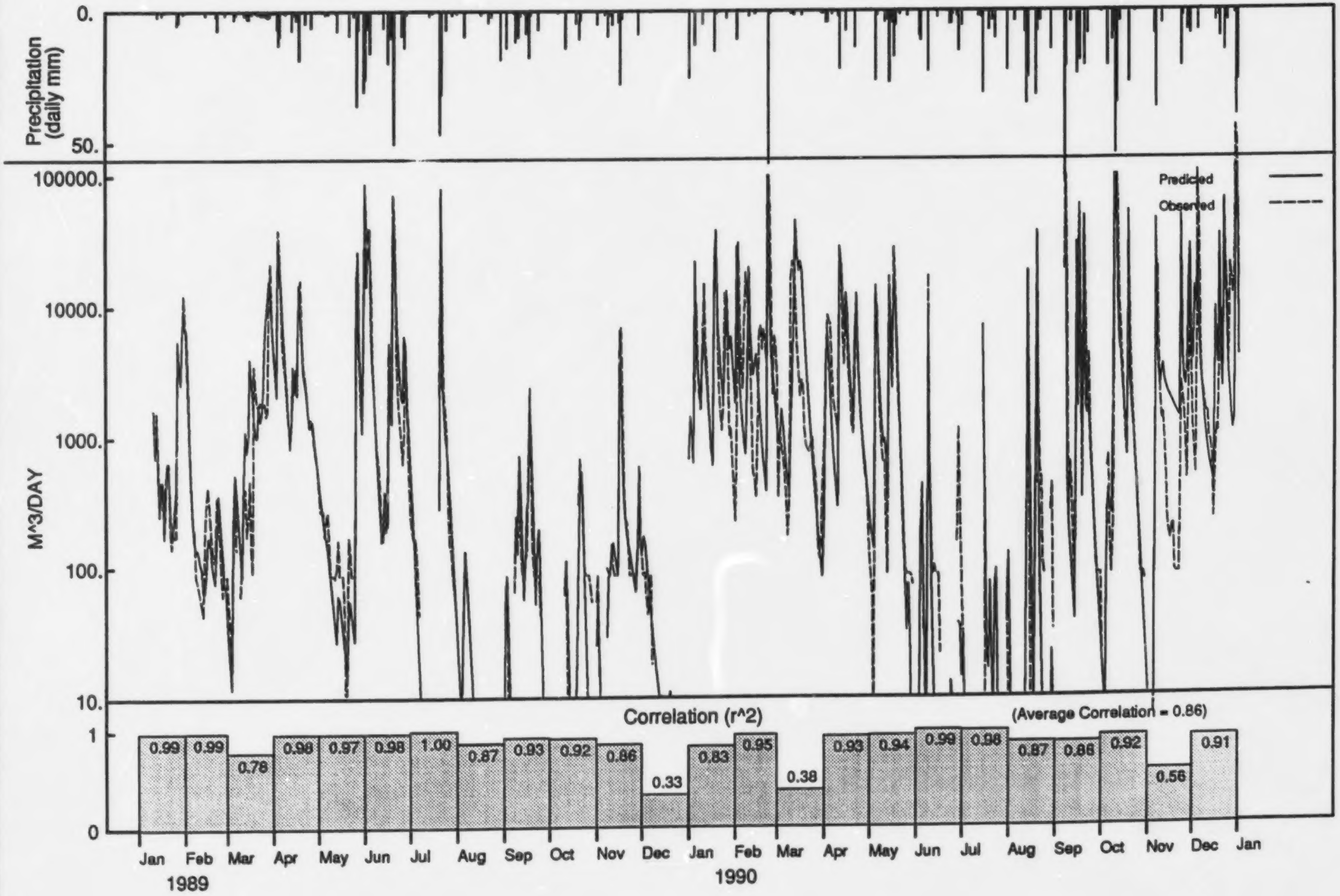


Figure 4.38: Essex Test Cumulative Streamflow, 1989-90

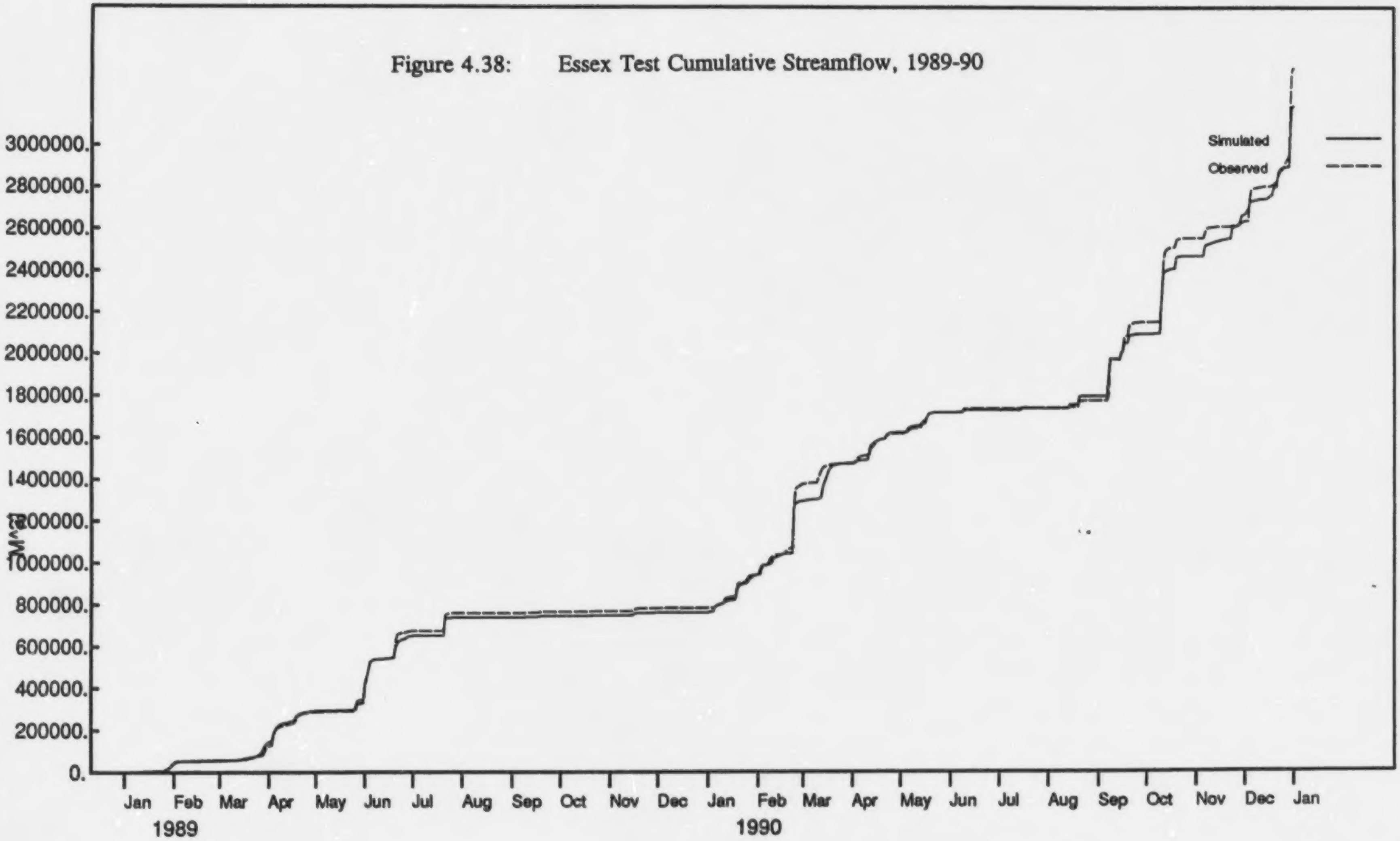


Figure 4.39: Essex Test Soil Loss, 1989-90

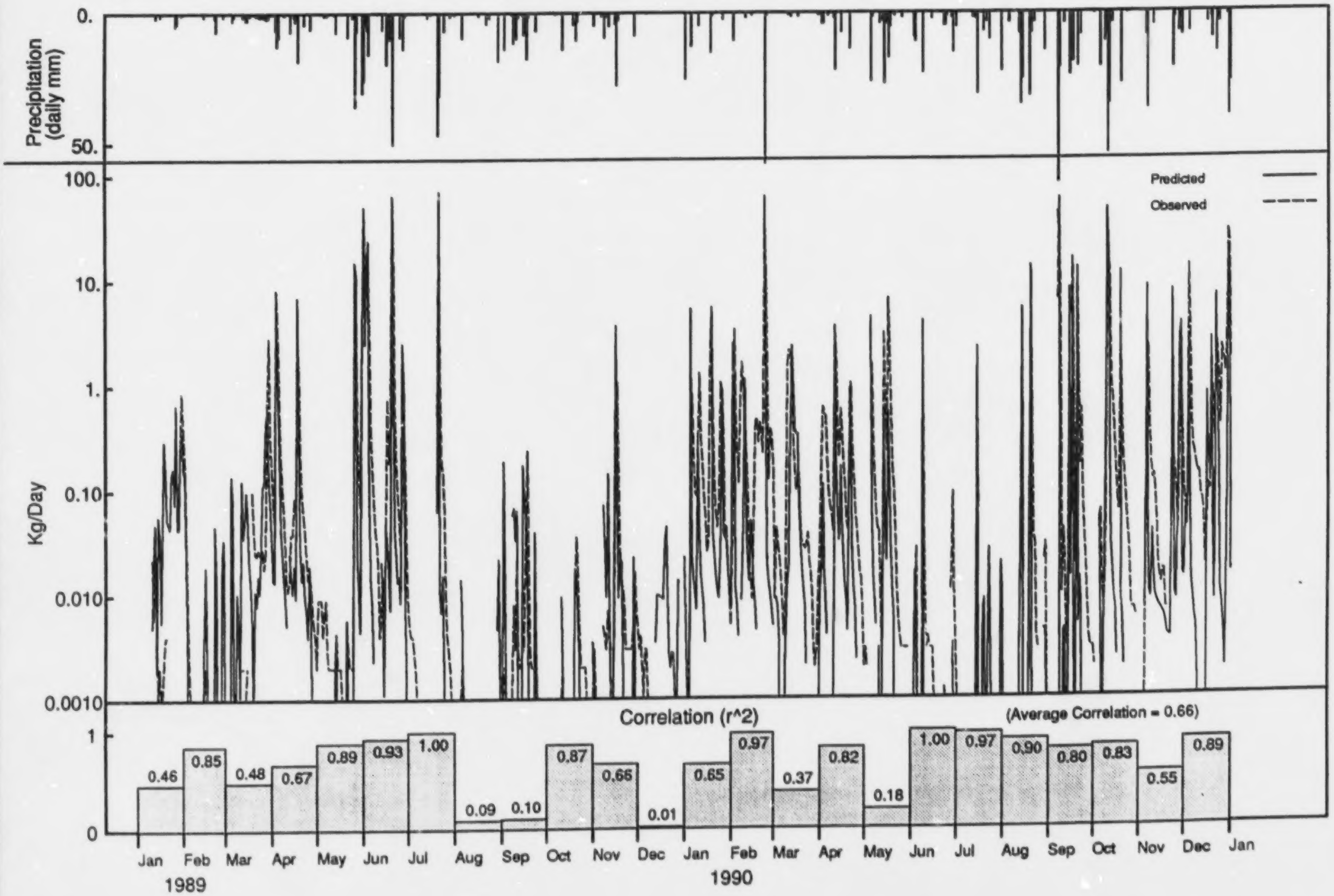


Figure 4.40: Essex Test Cumulative Soil Loss, 1989-90

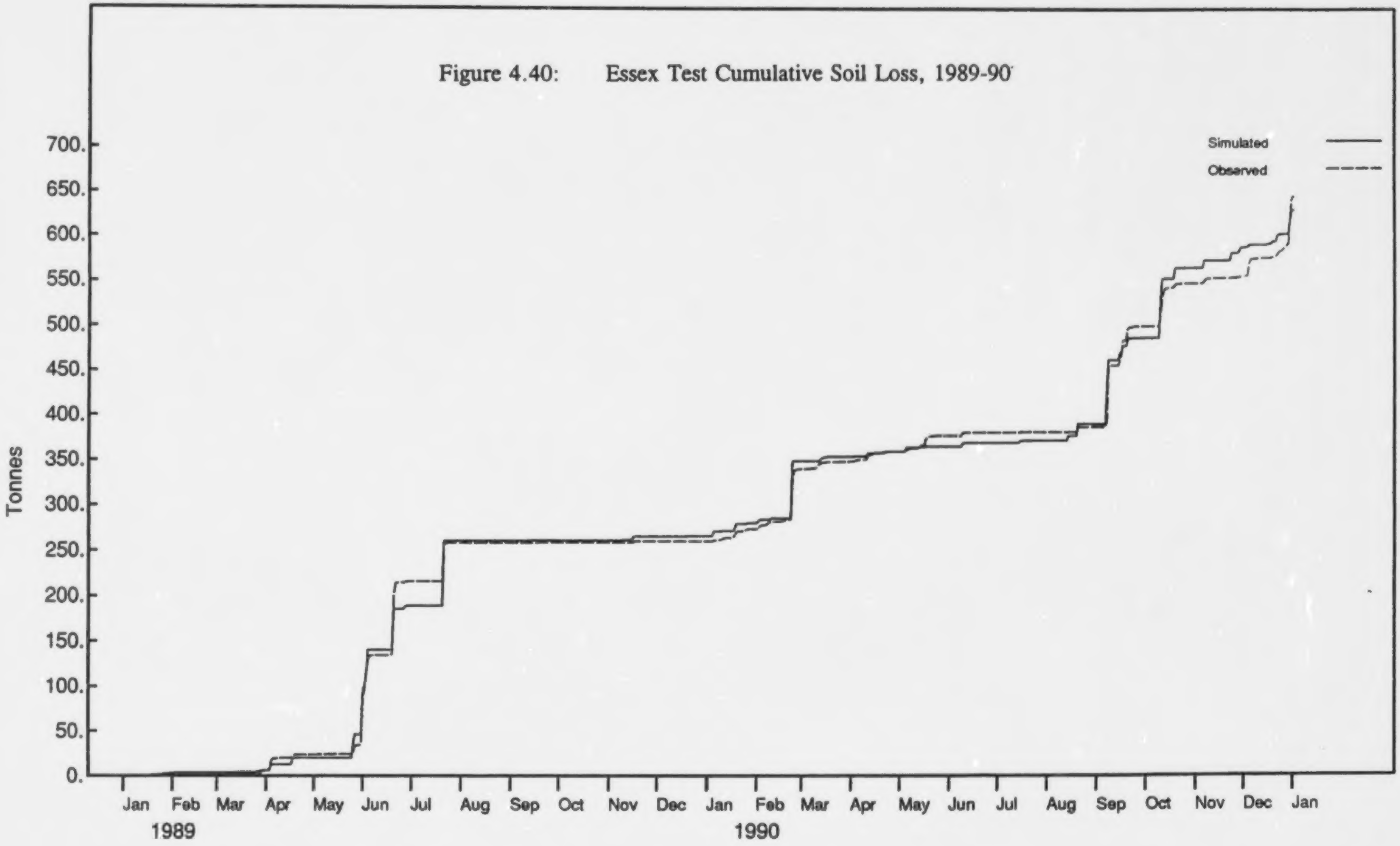


Figure 4.41: Essex Test Phosphorus Loss, 1989-90

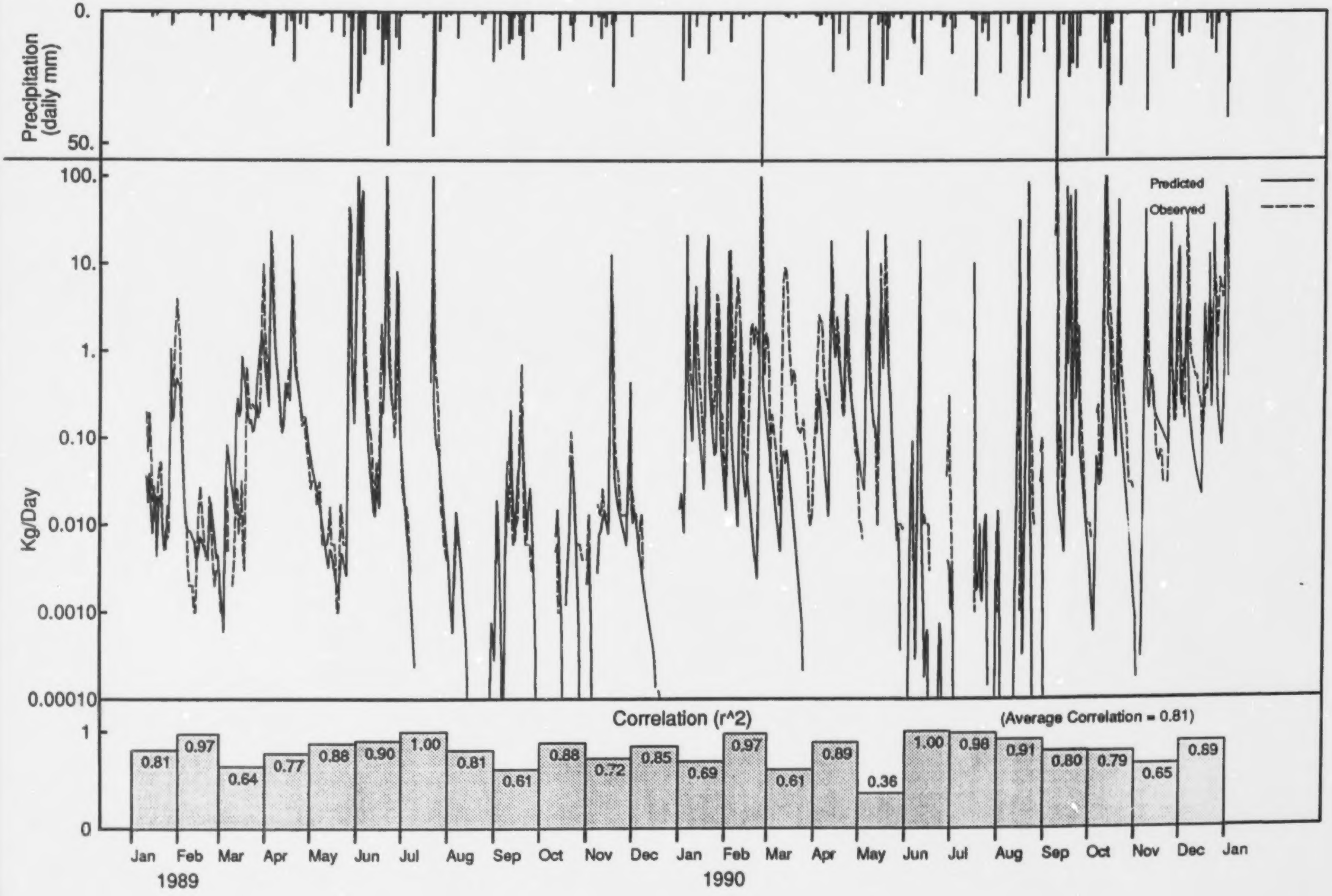


Figure 4.42: Essex Test Cumulative Phosphorus Loss, 1989-90

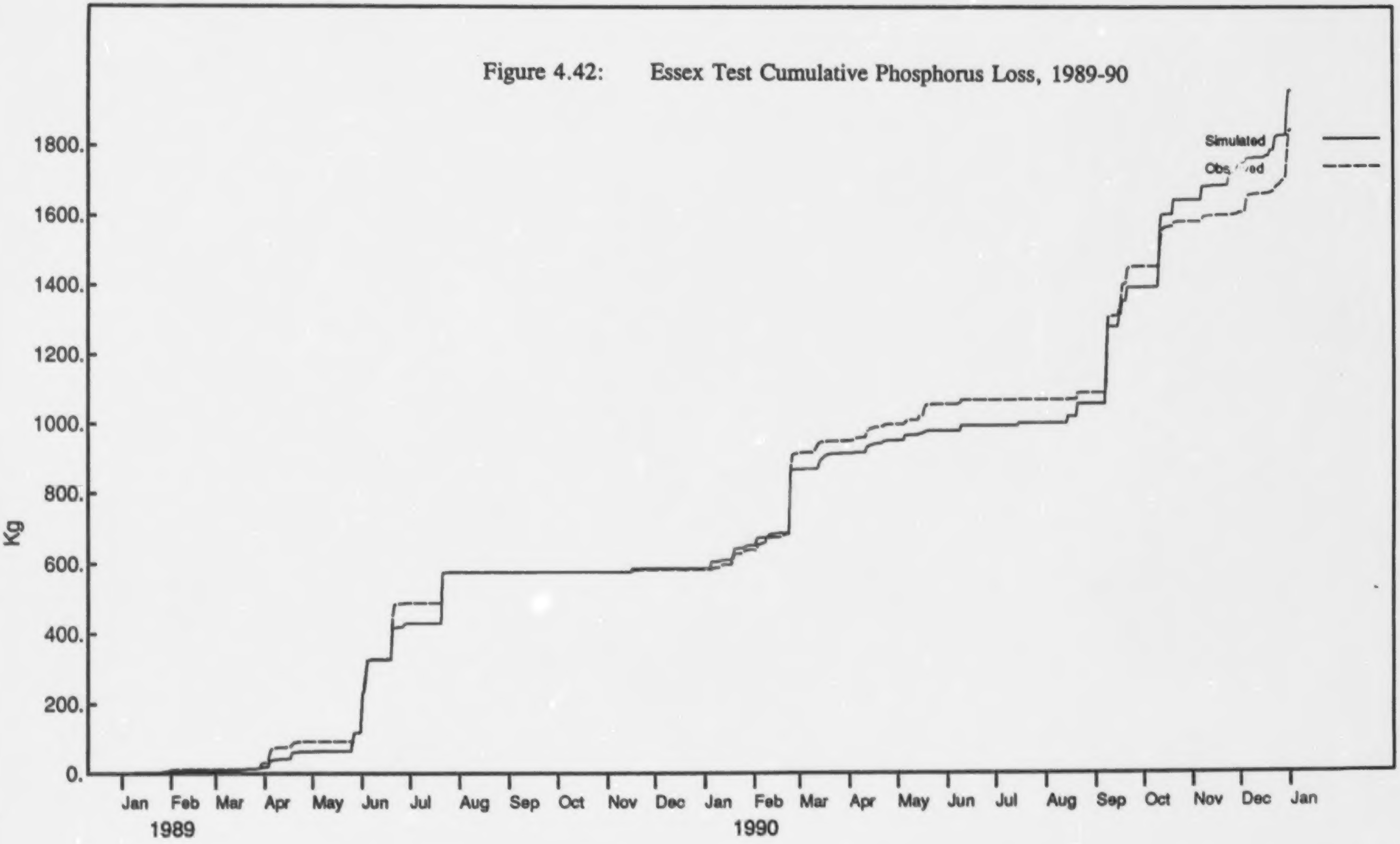
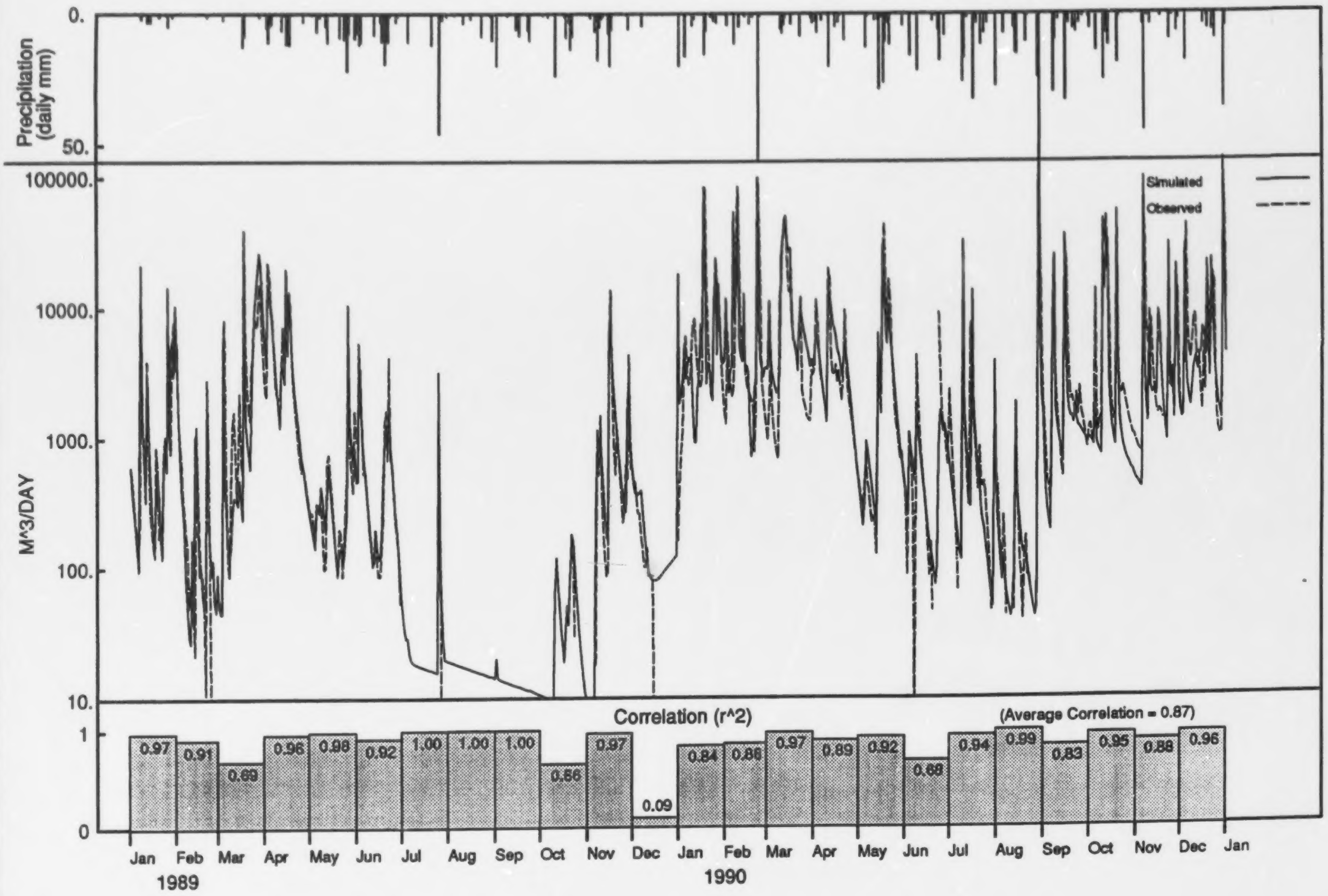


Figure 4.43: Kettle Creek Test Streamflow, 1989-90



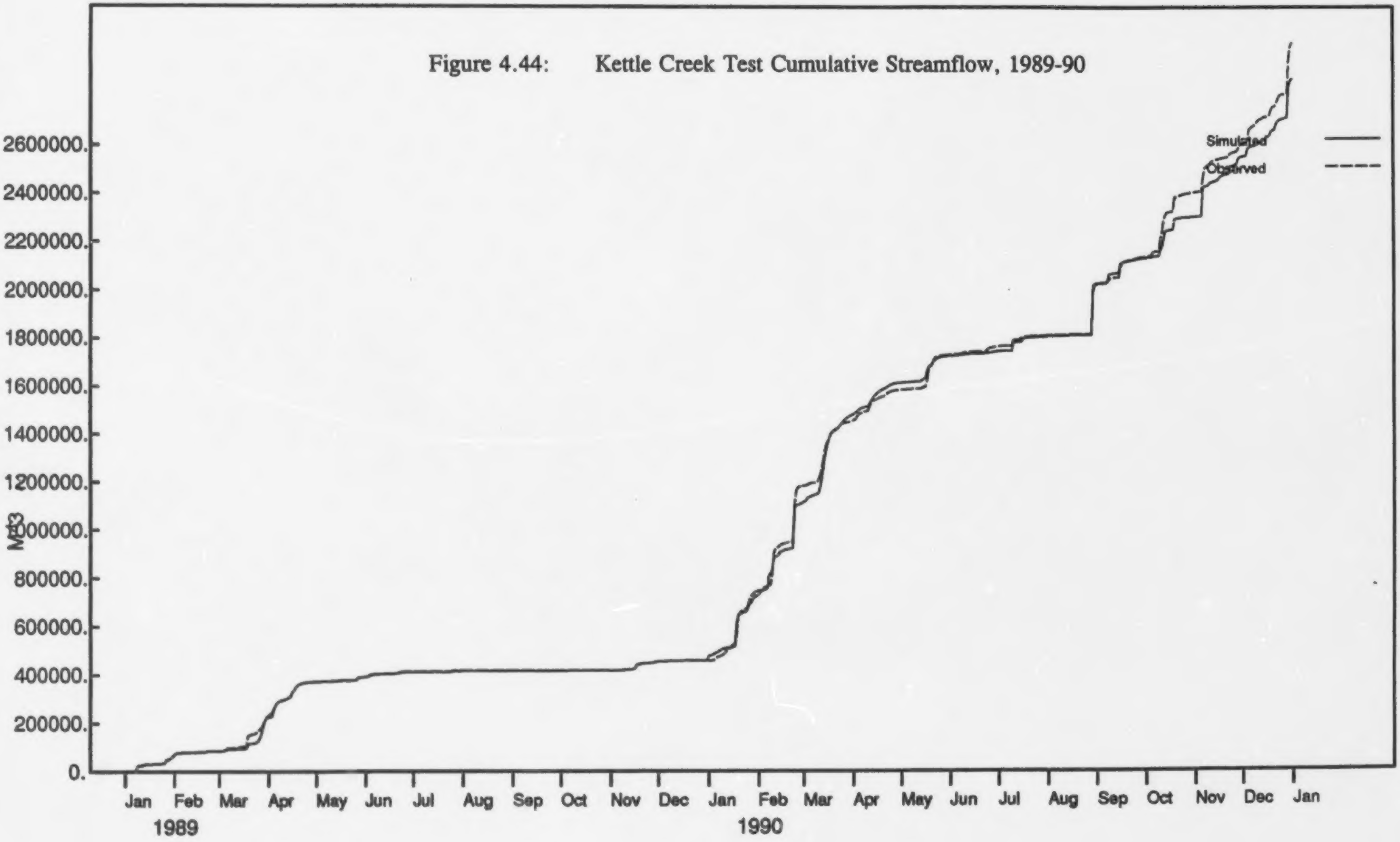


Figure 4.44: Kettle Creek Test Cumulative Streamflow, 1989-90

Figure 4.45: Kettle Creek Test Soil Loss, 1989-90

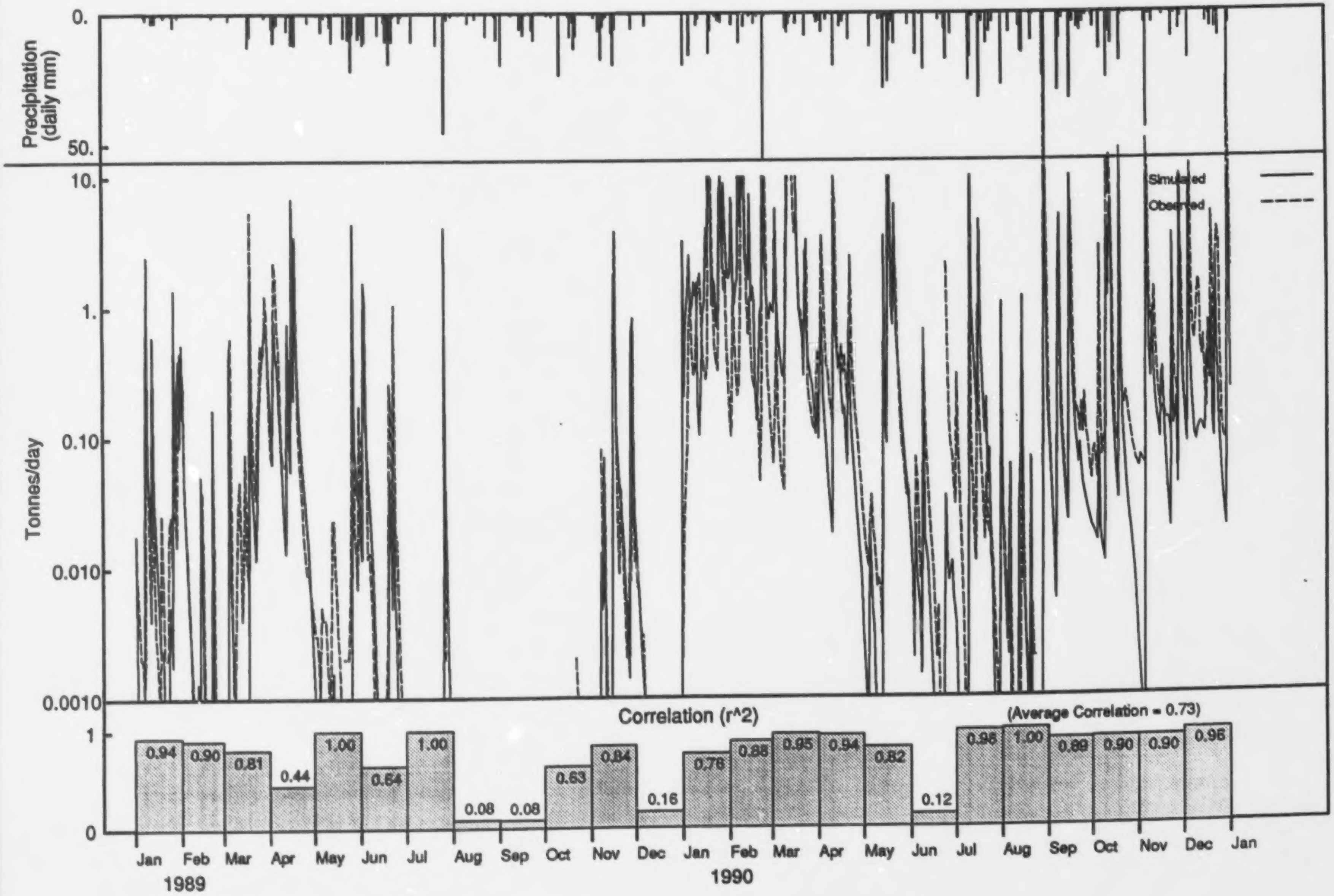


Figure 4.46: Kettle Creek Test Cumulative Soil Loss, 1989-90

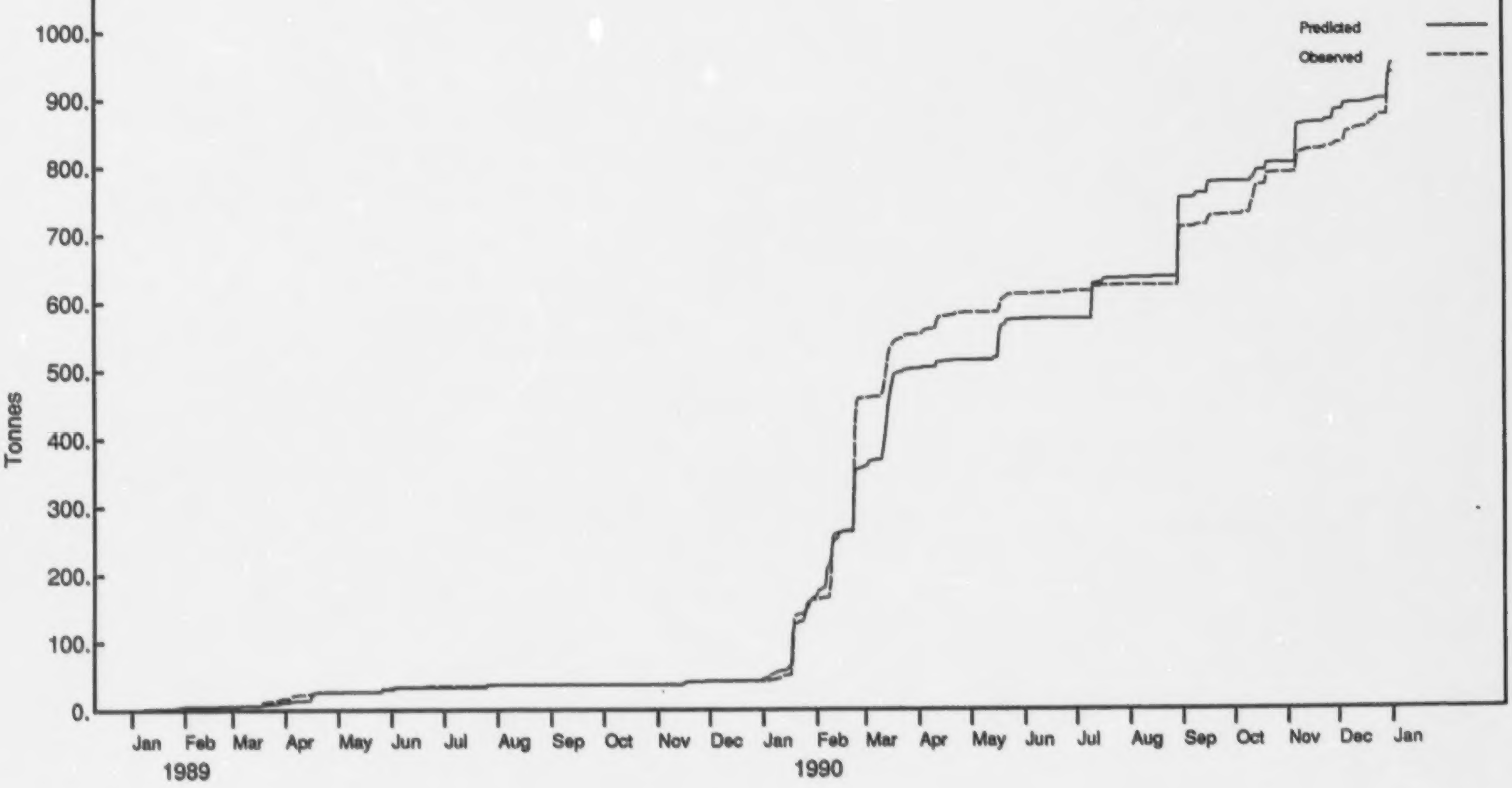


Figure 4.47: Kettle Creek Test Phosphorus Loss, 1989-90

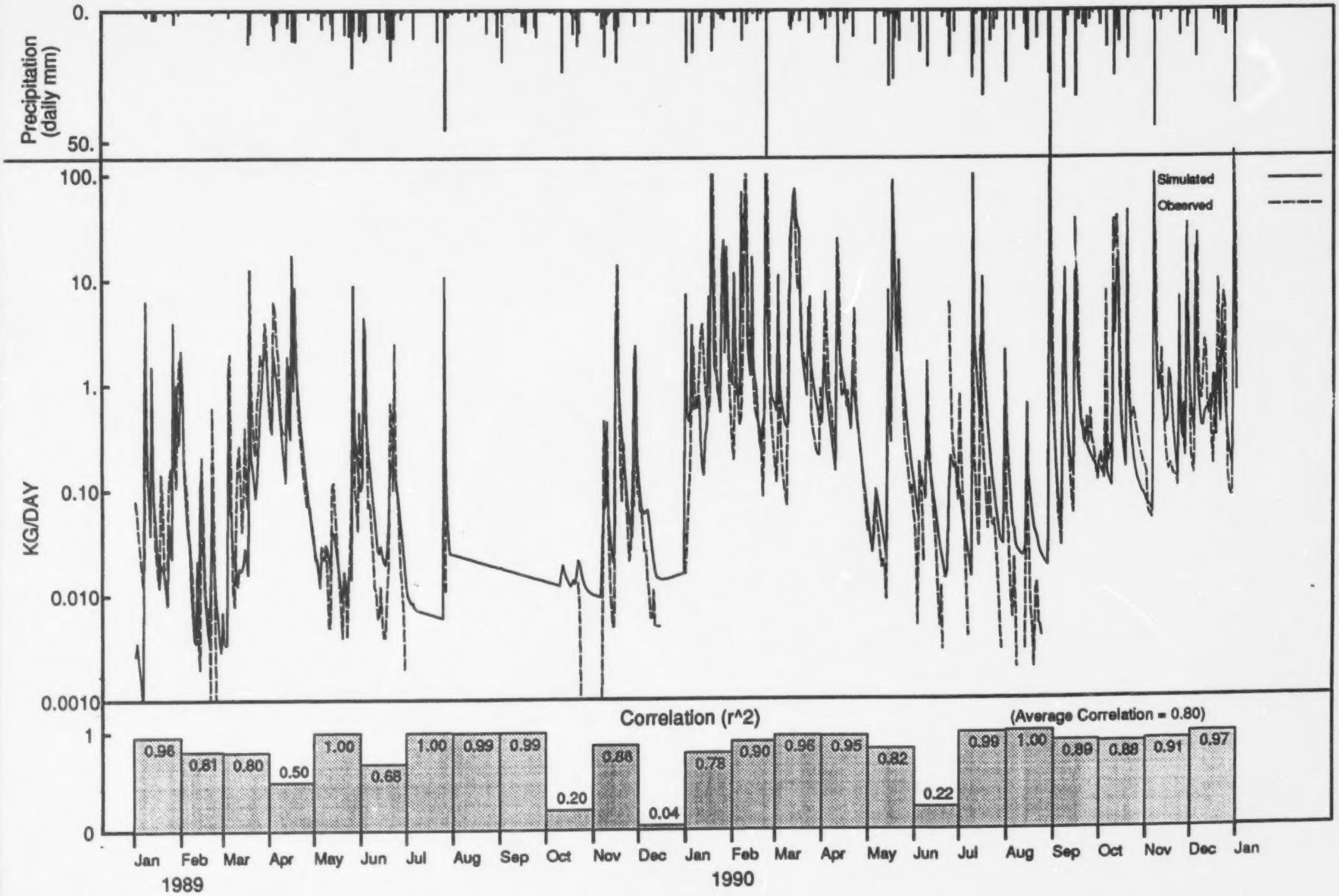


Figure 4.48: Kettle Creek Test Cumulative Phosphorus Loss, 1989-90

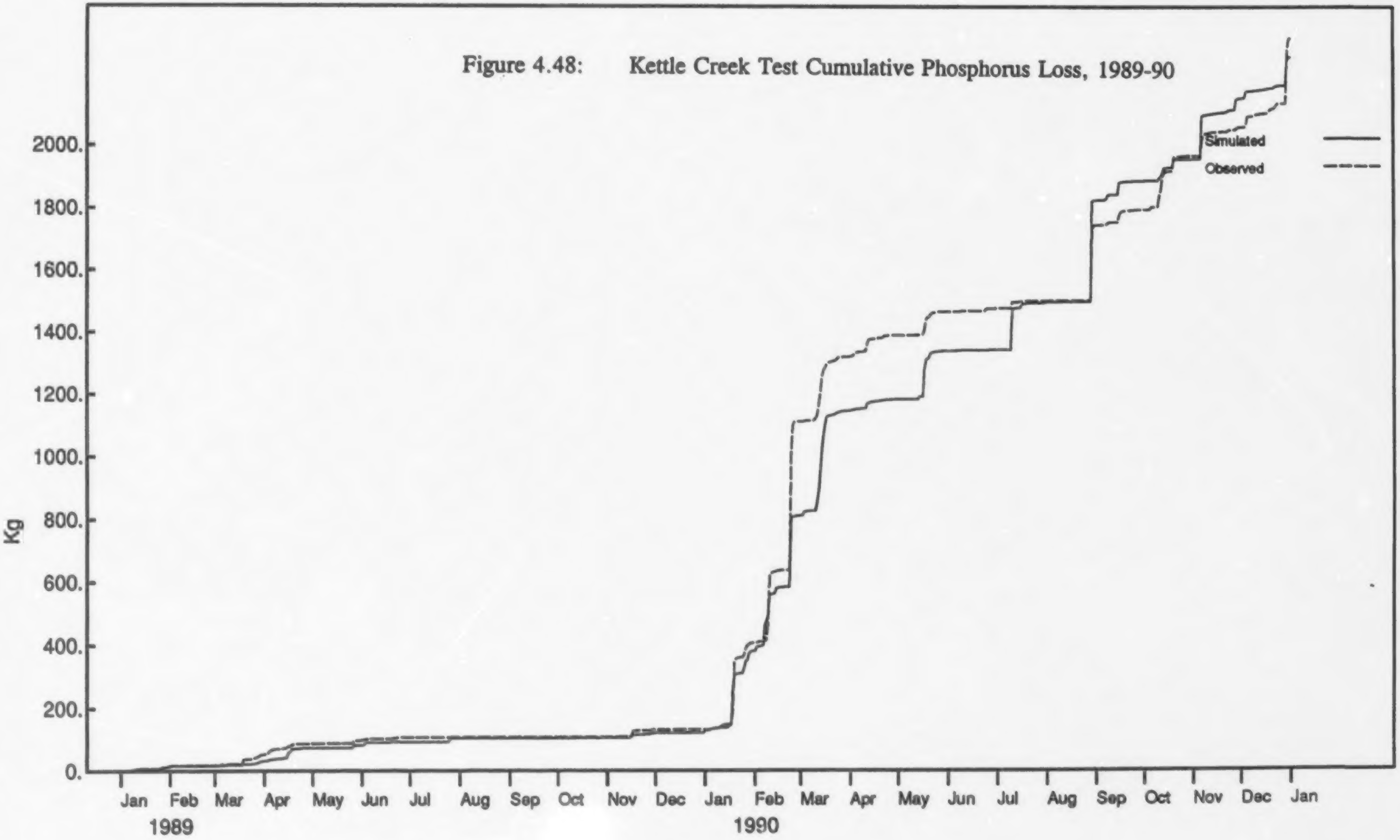
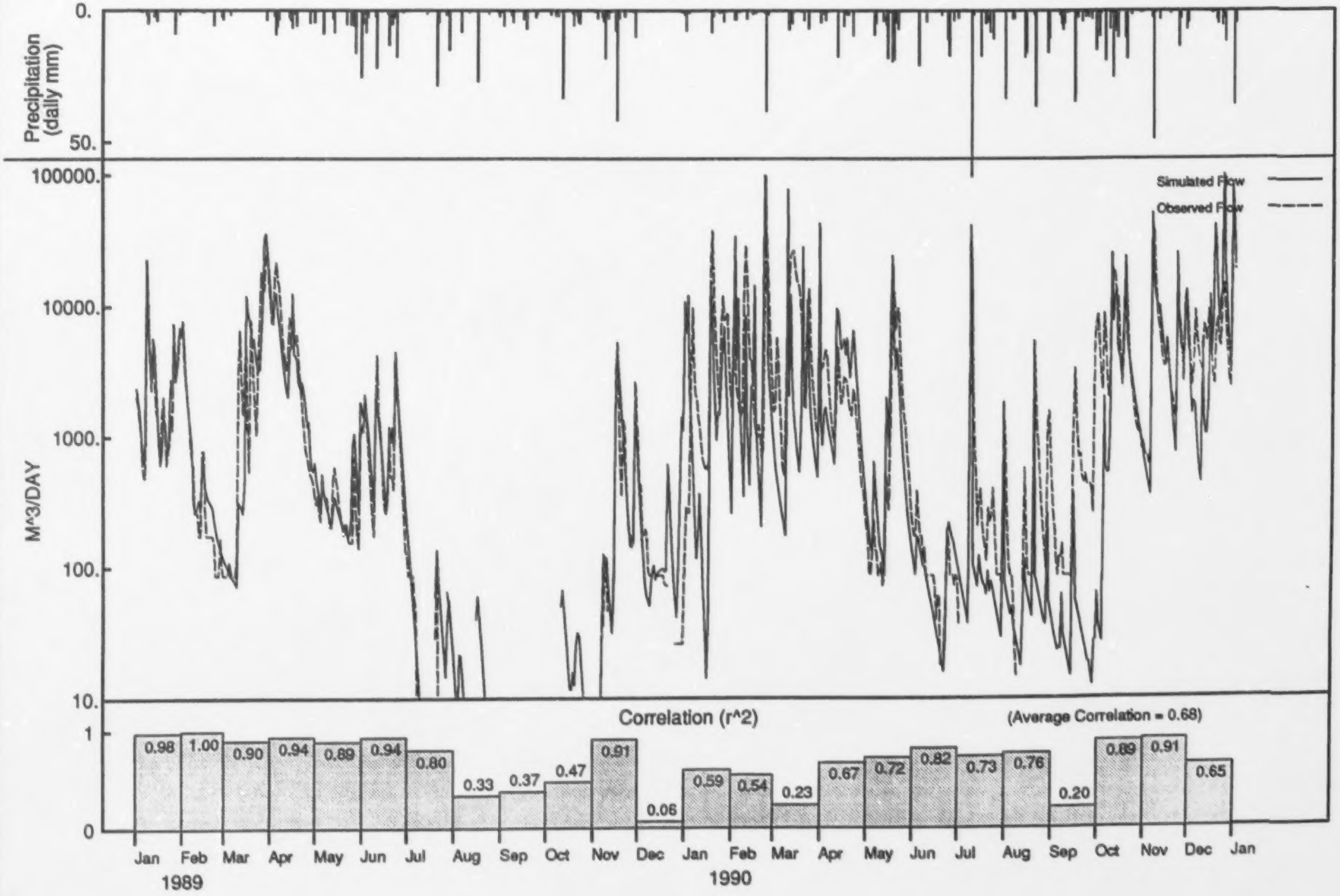


Figure 4.49: Pittock Test Streamflow, 1989-90



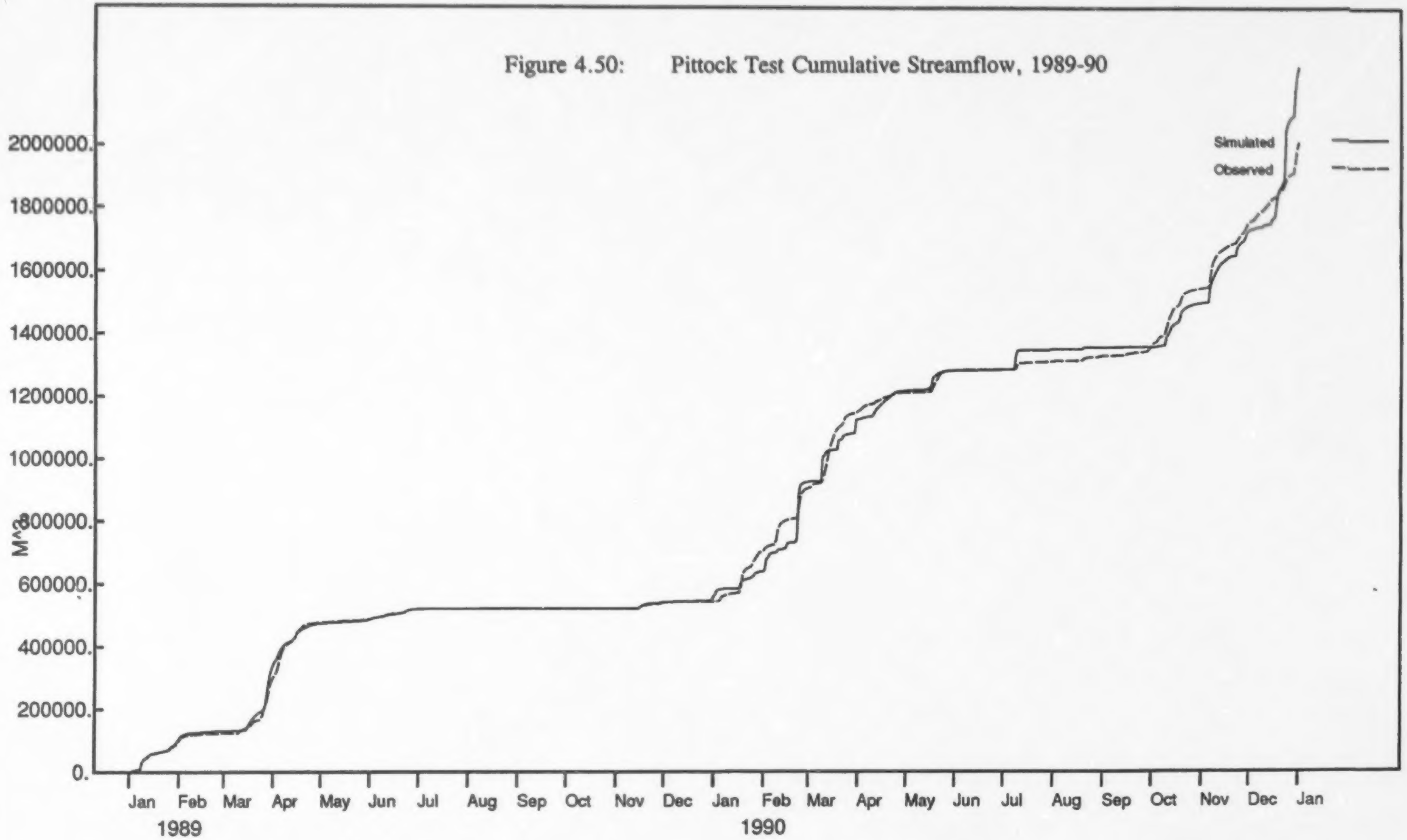


Figure 4.50: Pittock Test Cumulative Streamflow, 1989-90

Figure 4.51: Pittock Test Soil Loss, 1989-90

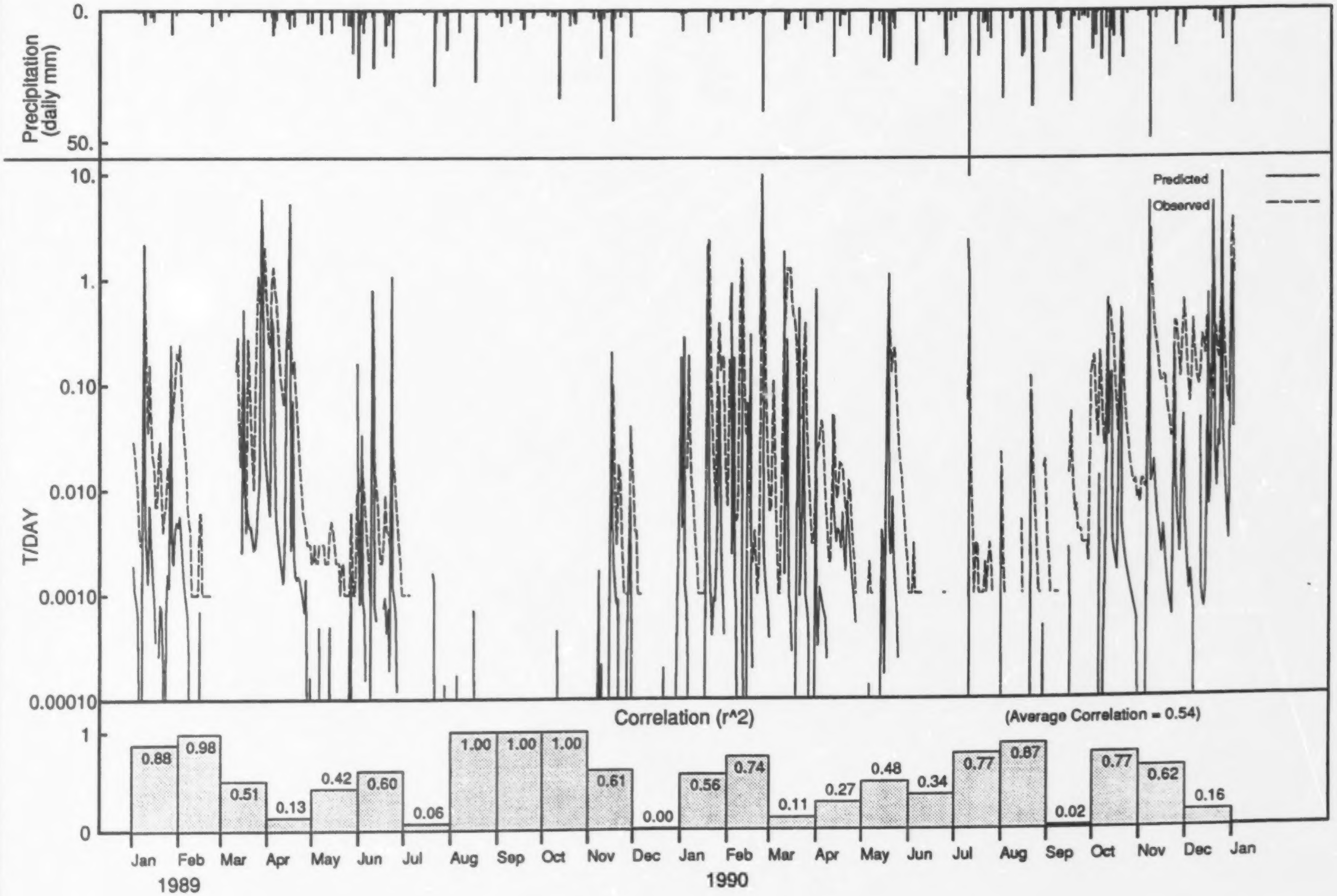


Figure 4.52: Pittock Test Cumulative Soil Loss, 1989-90

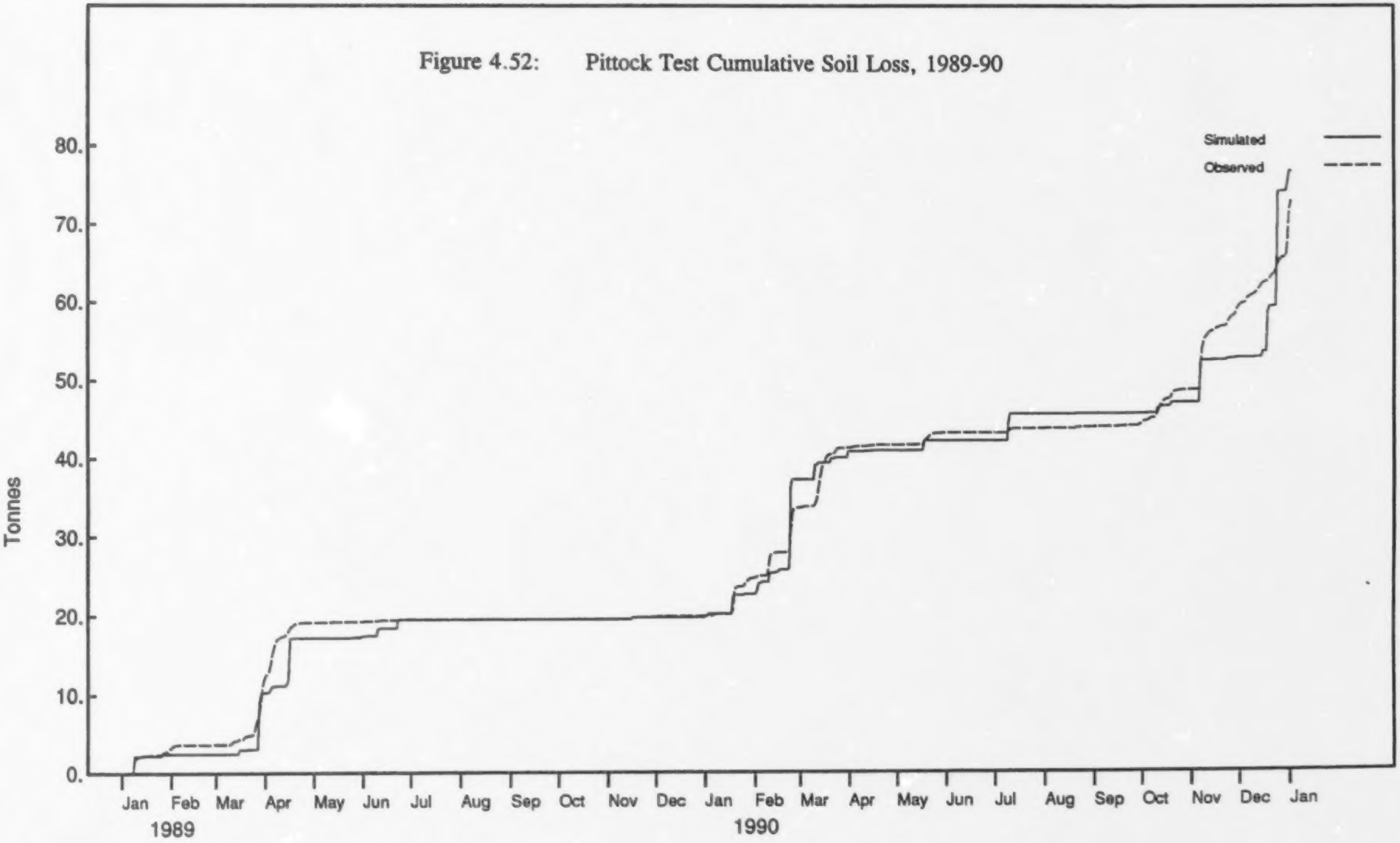
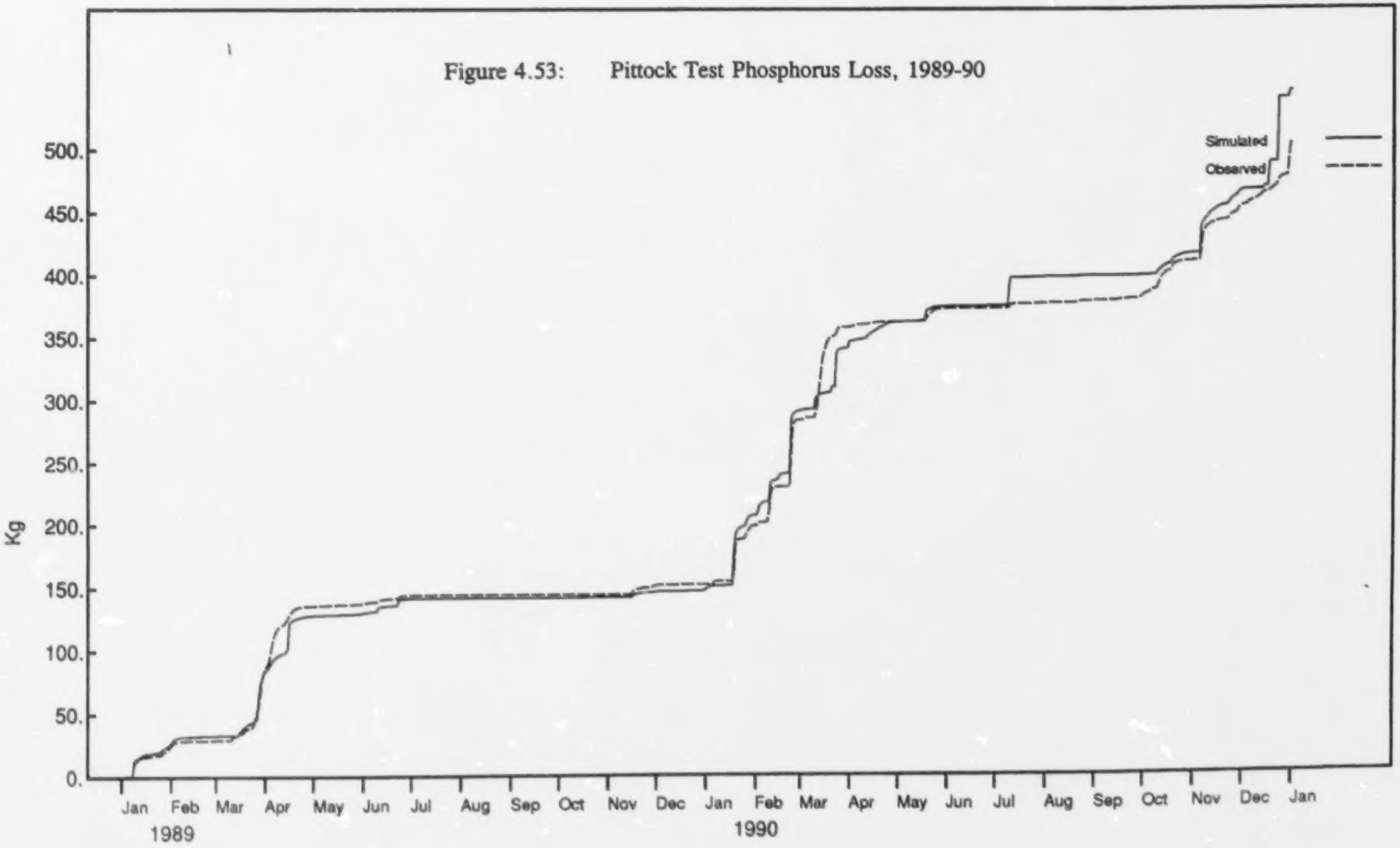


Figure 4.53: Pittock Test Phosphorus Loss, 1989-90



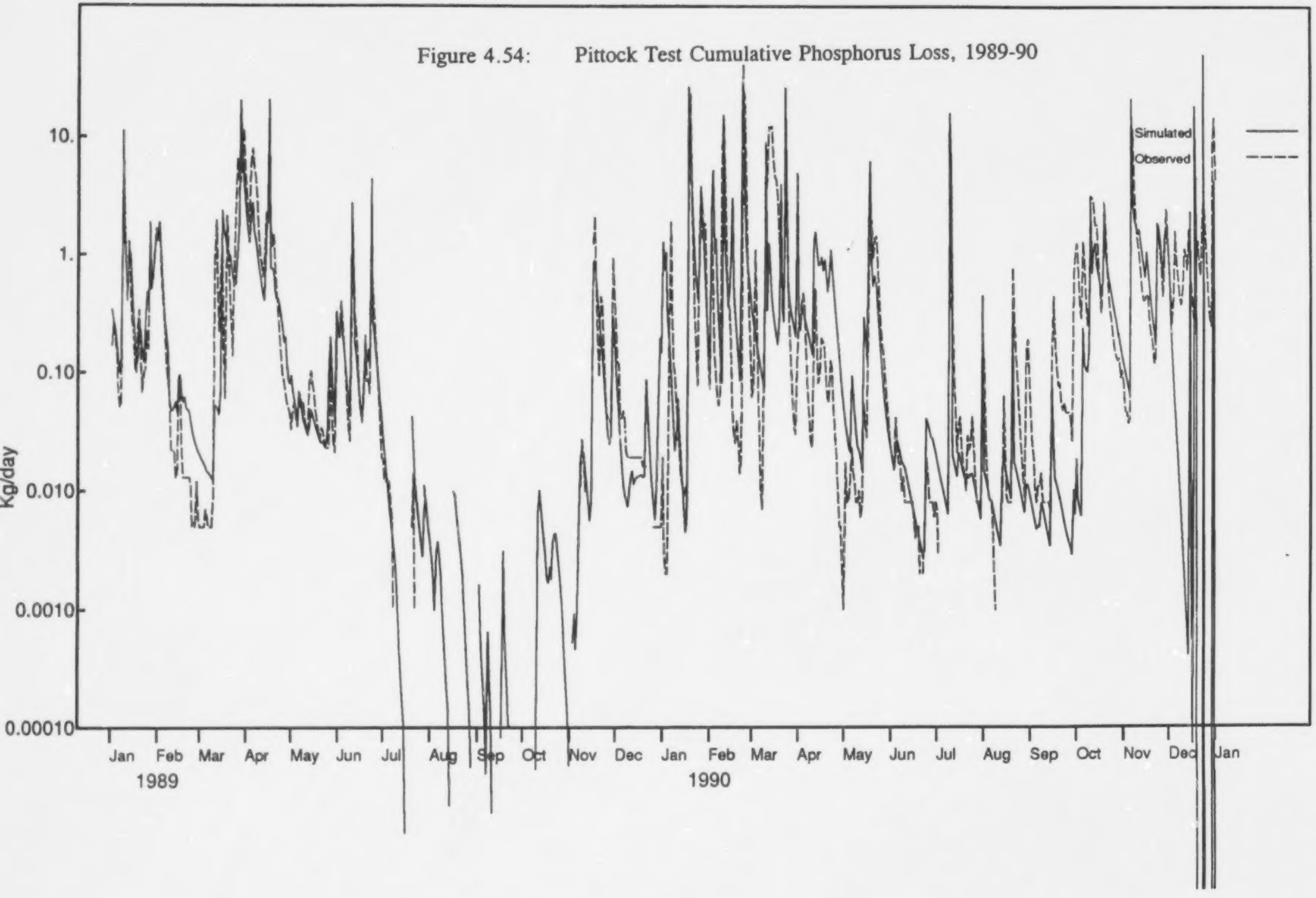


Figure 4.54: Pittock Test Cumulative Phosphorus Loss, 1989-90

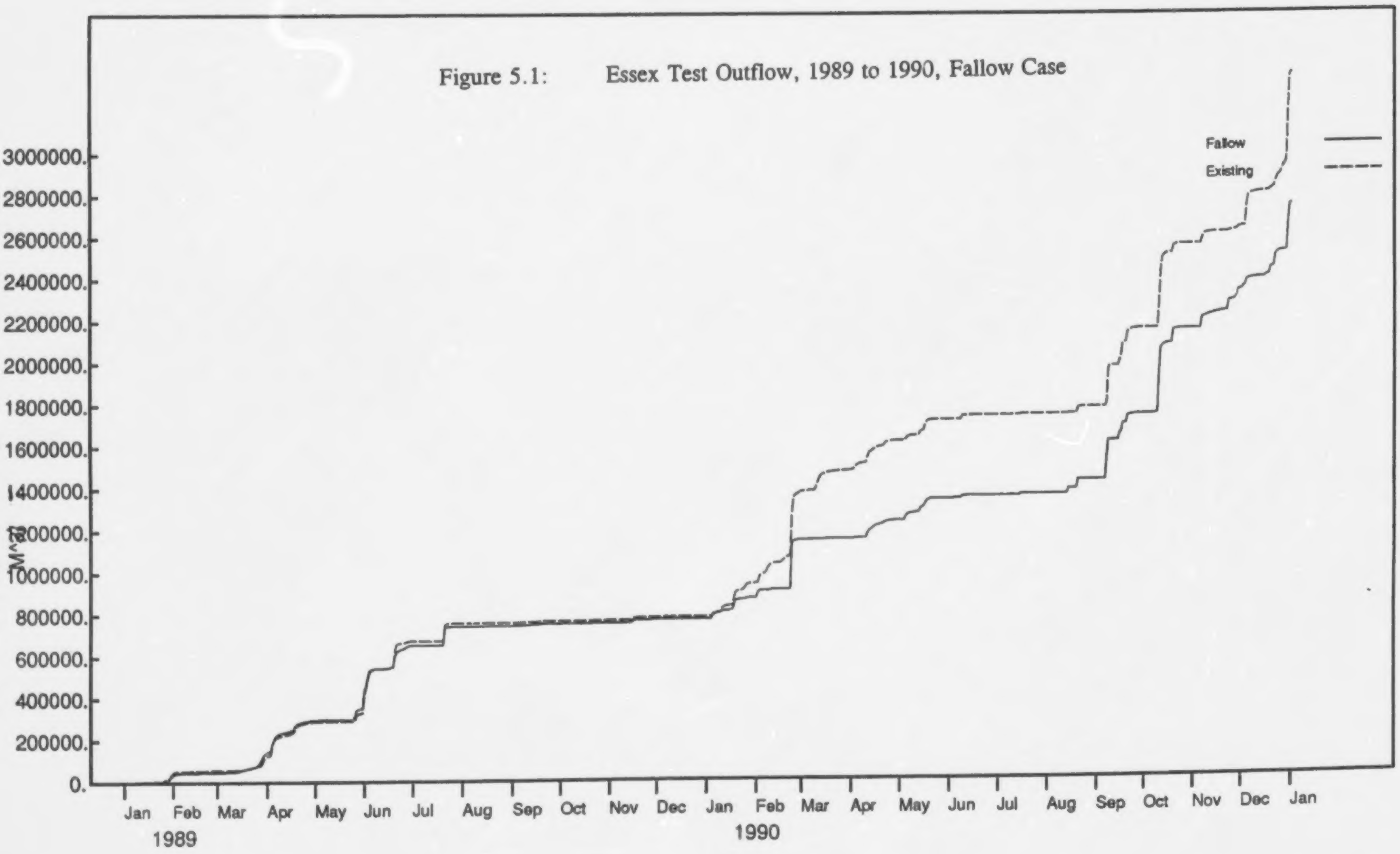


Figure 5.1: Essex Test Outflow, 1989 to 1990, Fallow Case

Figure 5.2: Essex Test Outflow, 1989 to 1990, No Till Case

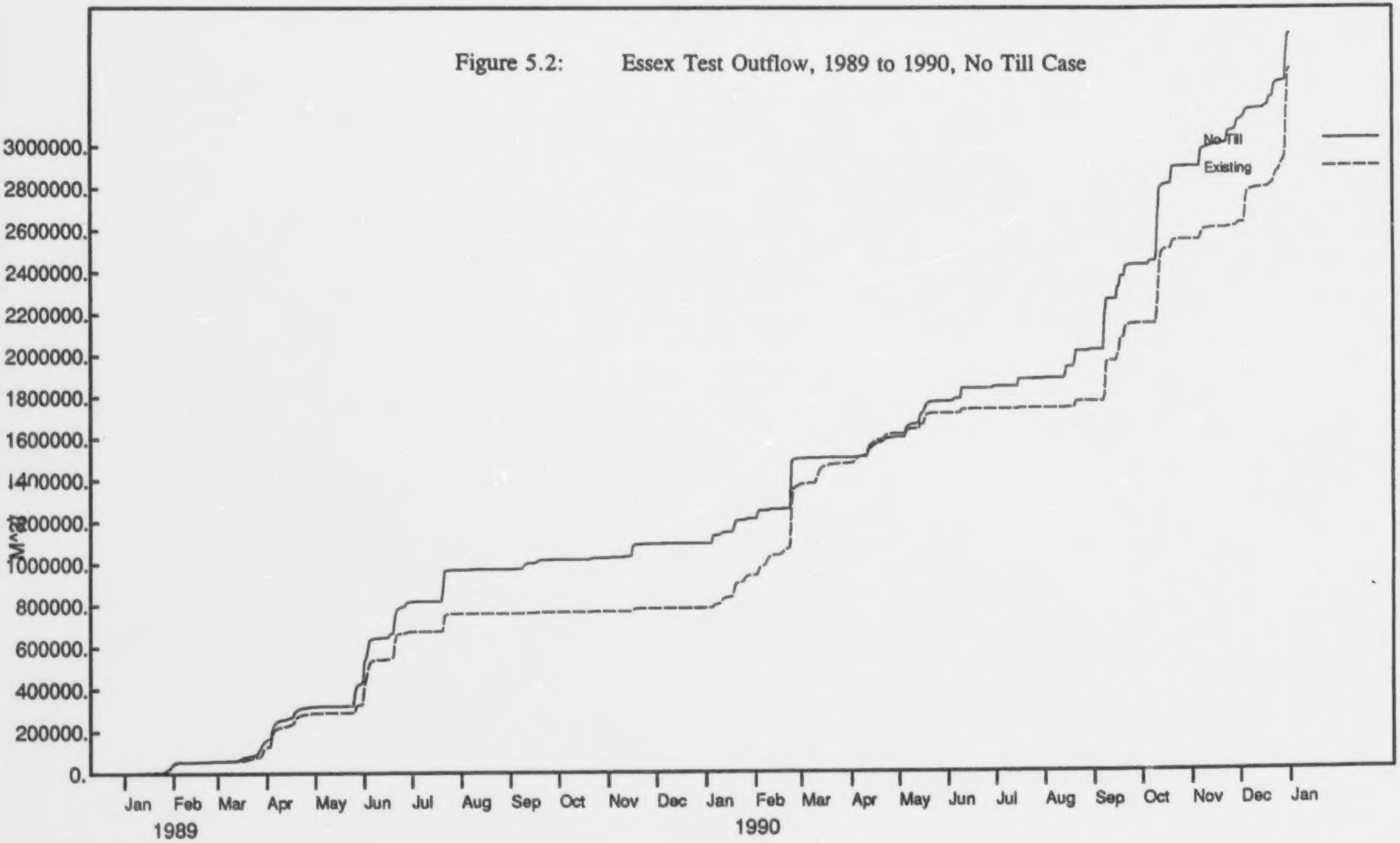


Figure 5.3: Essex Test Soil Loss, 1989 to 1990, Fallow Case

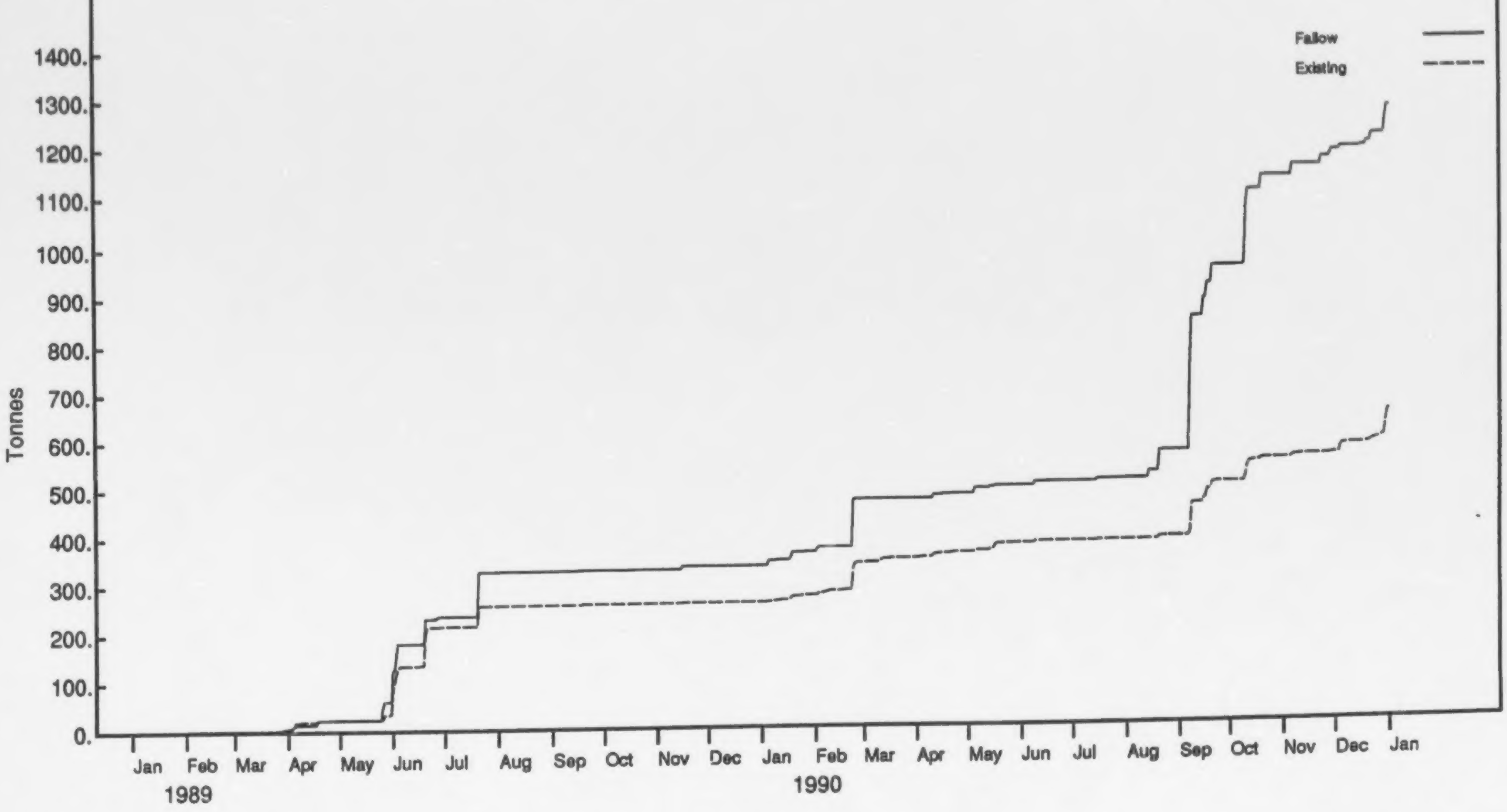
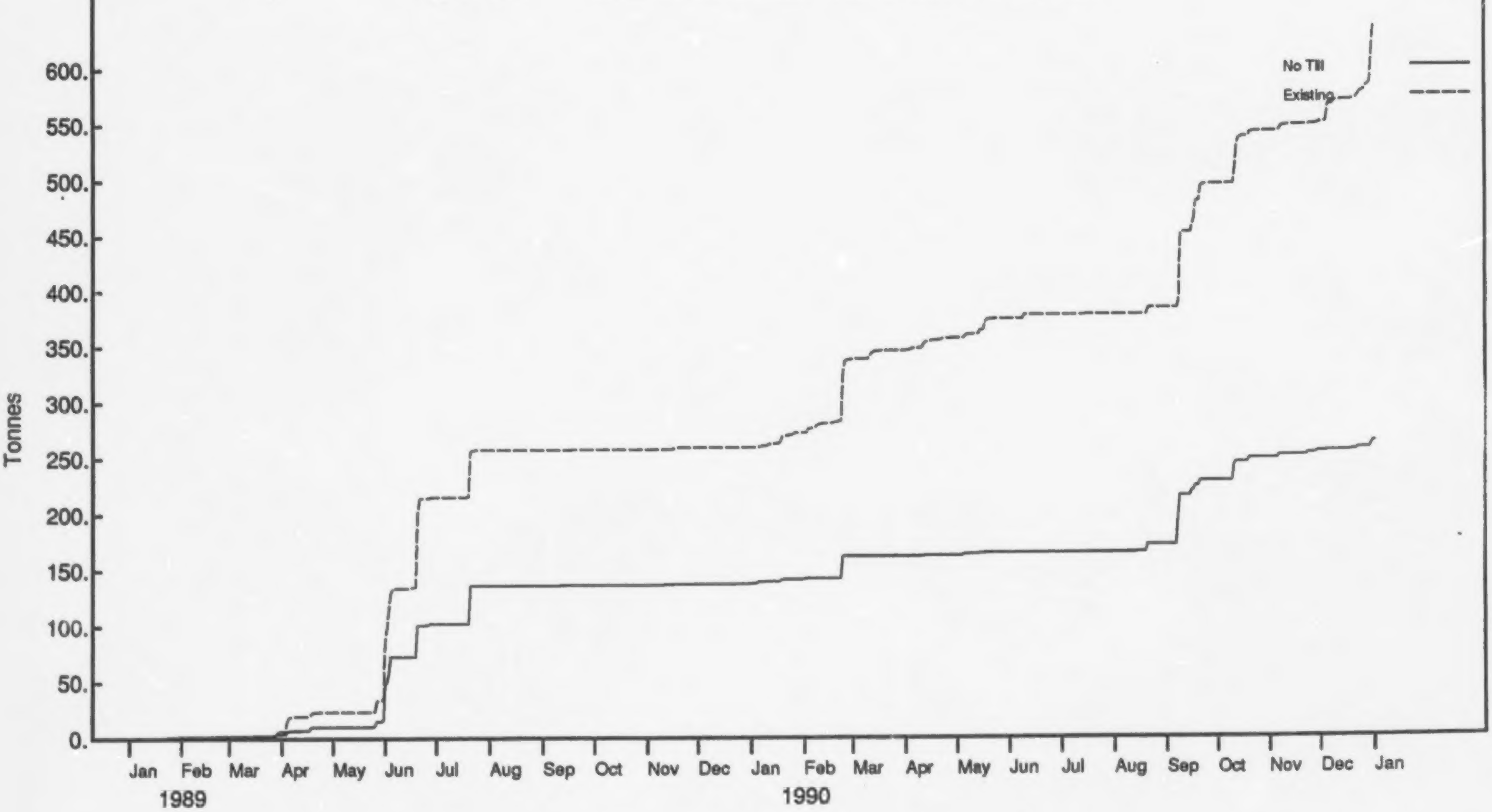


Figure 5.4: Essex Test Soil Loss, 1989 to 1990, No Till Case



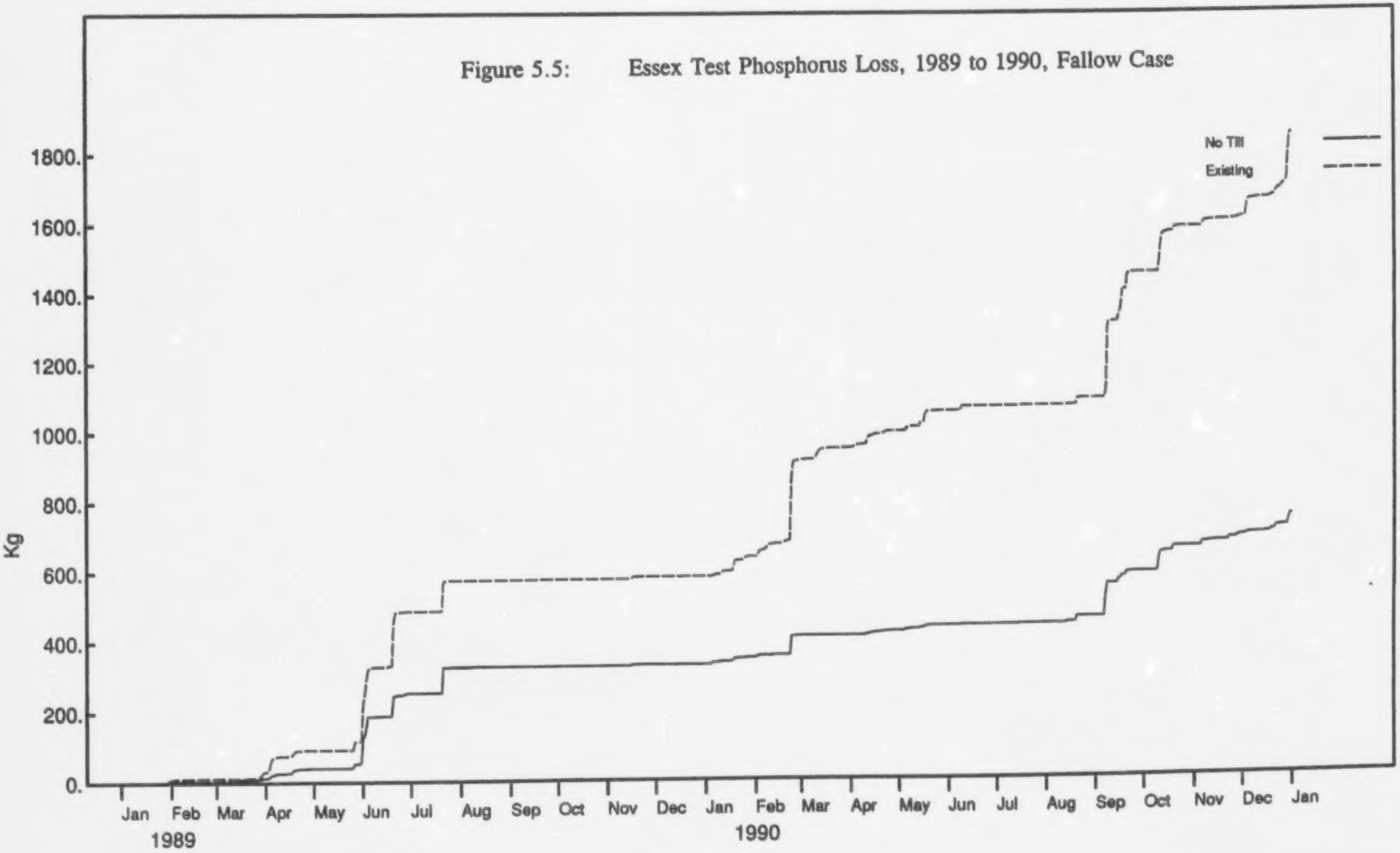


Figure 5.5: Essex Test Phosphorus Loss, 1989 to 1990, Fallow Case

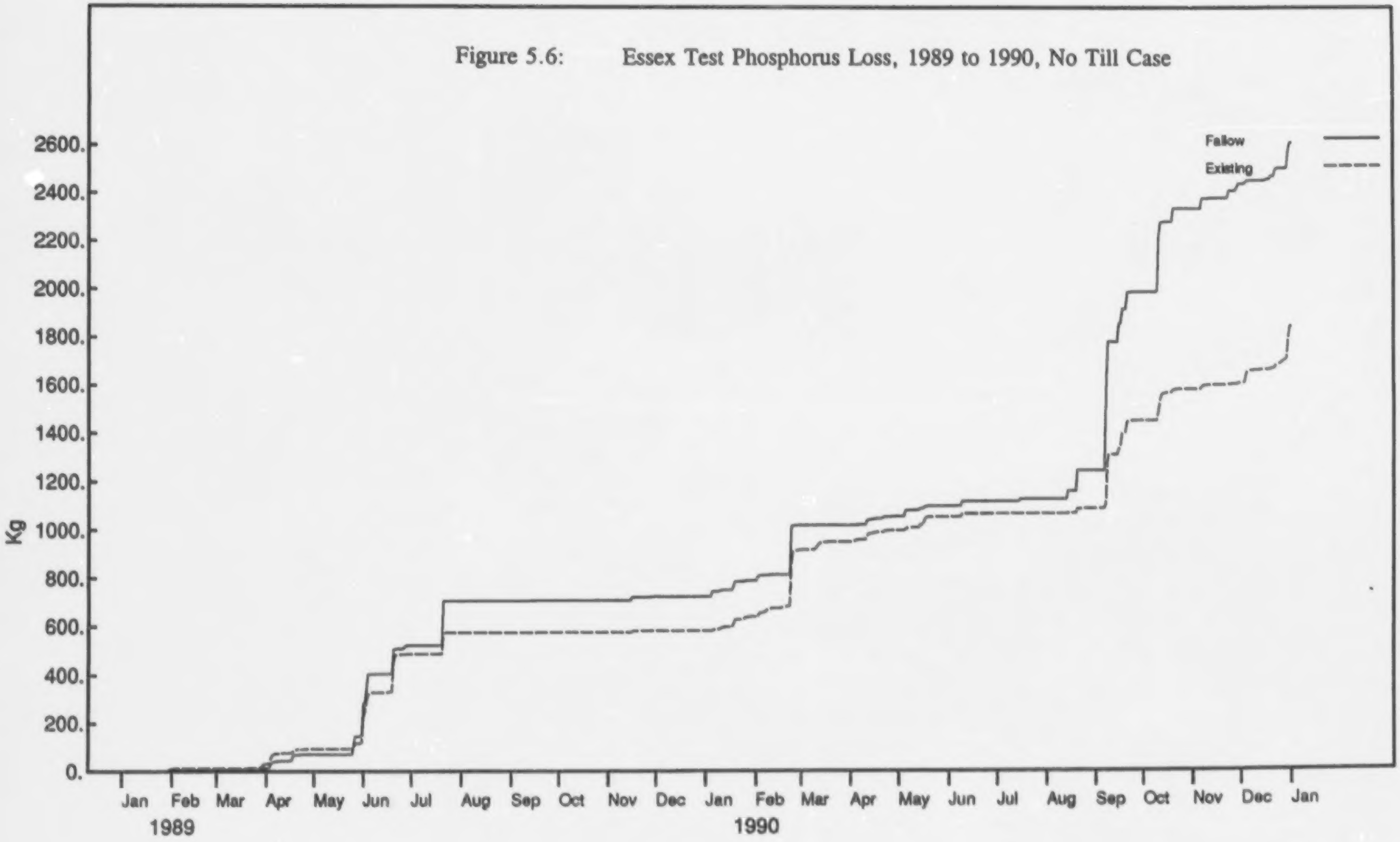
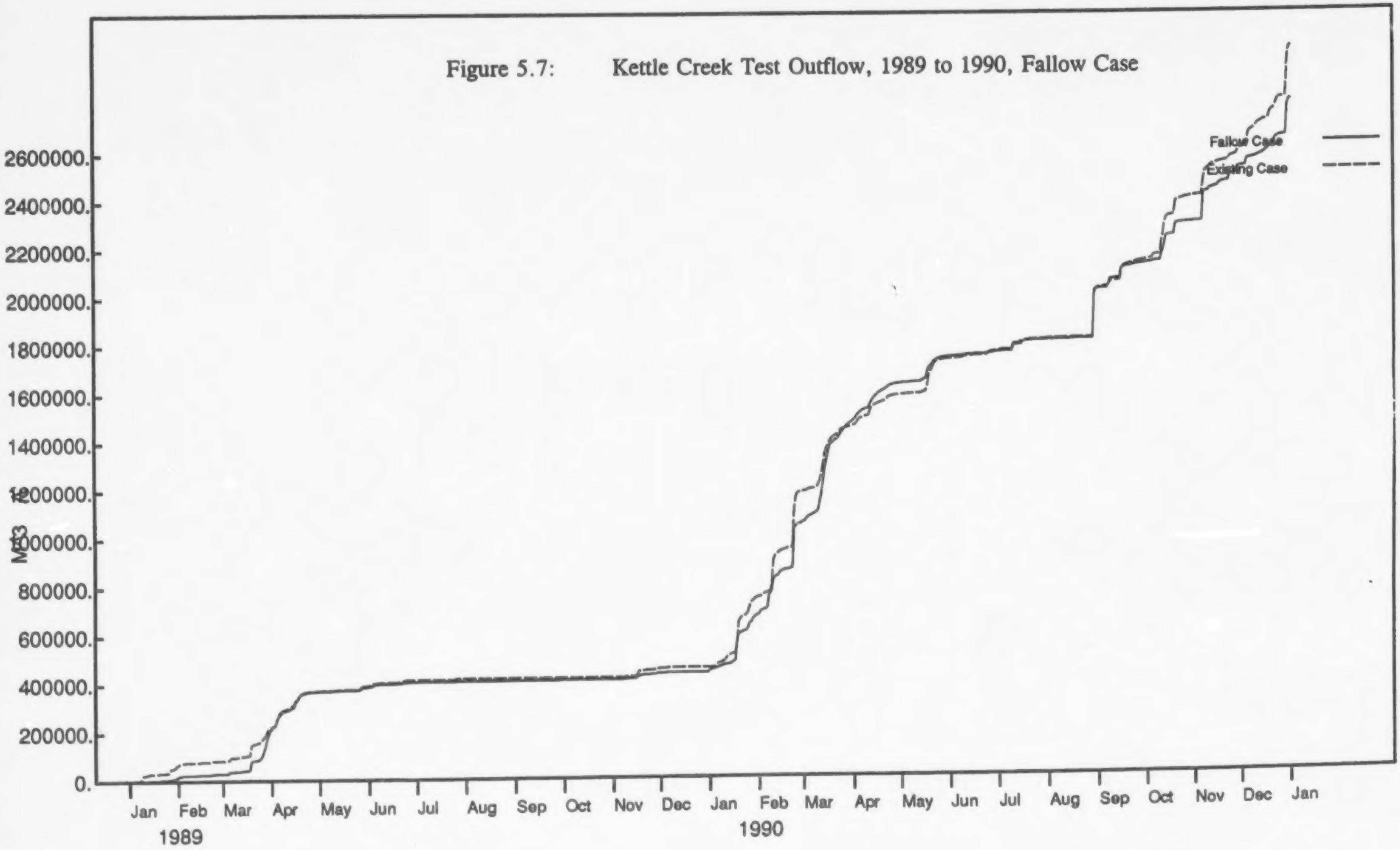


Figure 5.6: Essex Test Phosphorus Loss, 1989 to 1990, No Till Case

Figure 5.7: Kettle Creek Test Outflow, 1989 to 1990, Fallow Case



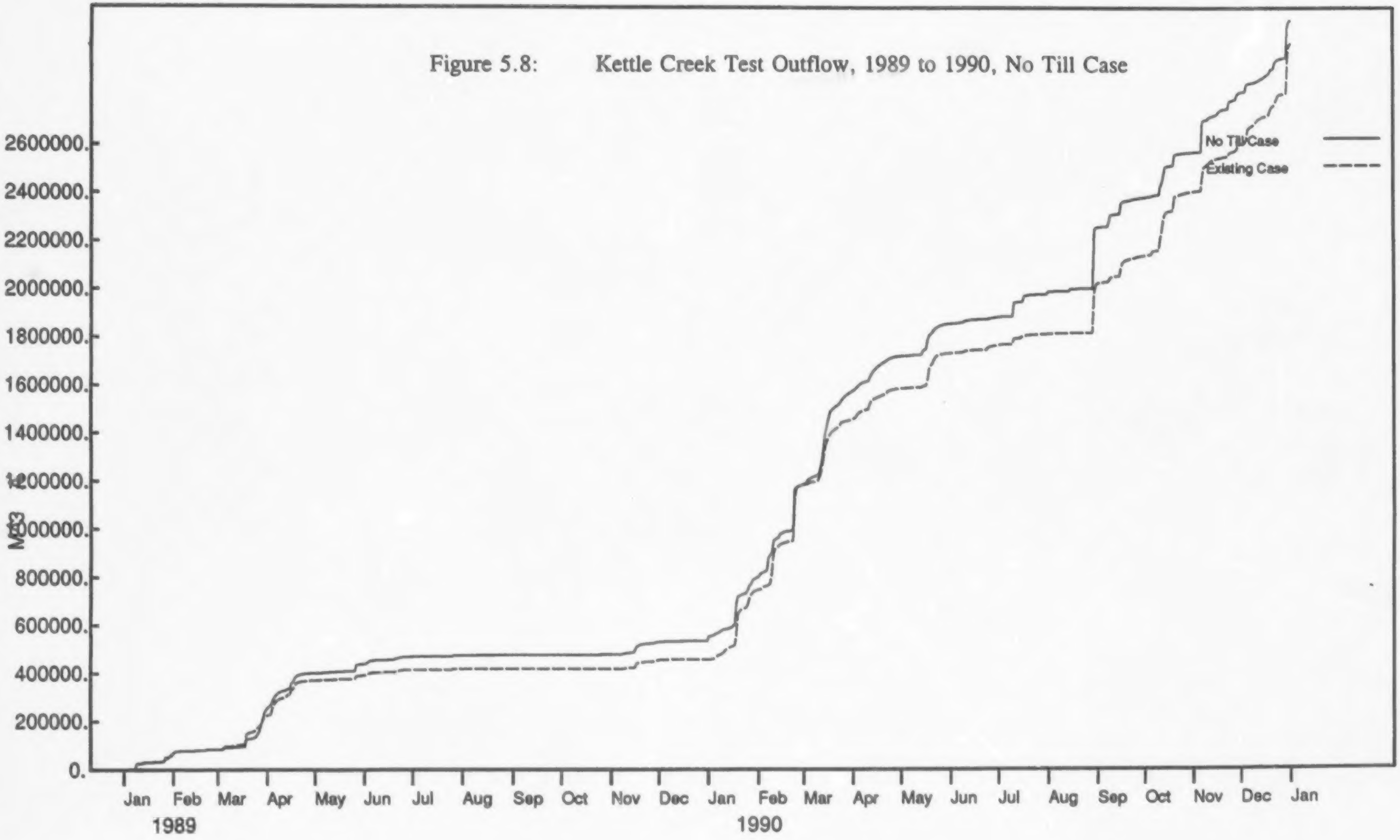


Figure 5.8: Kettle Creek Test Outflow, 1989 to 1990, No Till Case

Figure 5.9: Kettle Creek Test Soil Loss, 1989 to 1990, Fallow Case

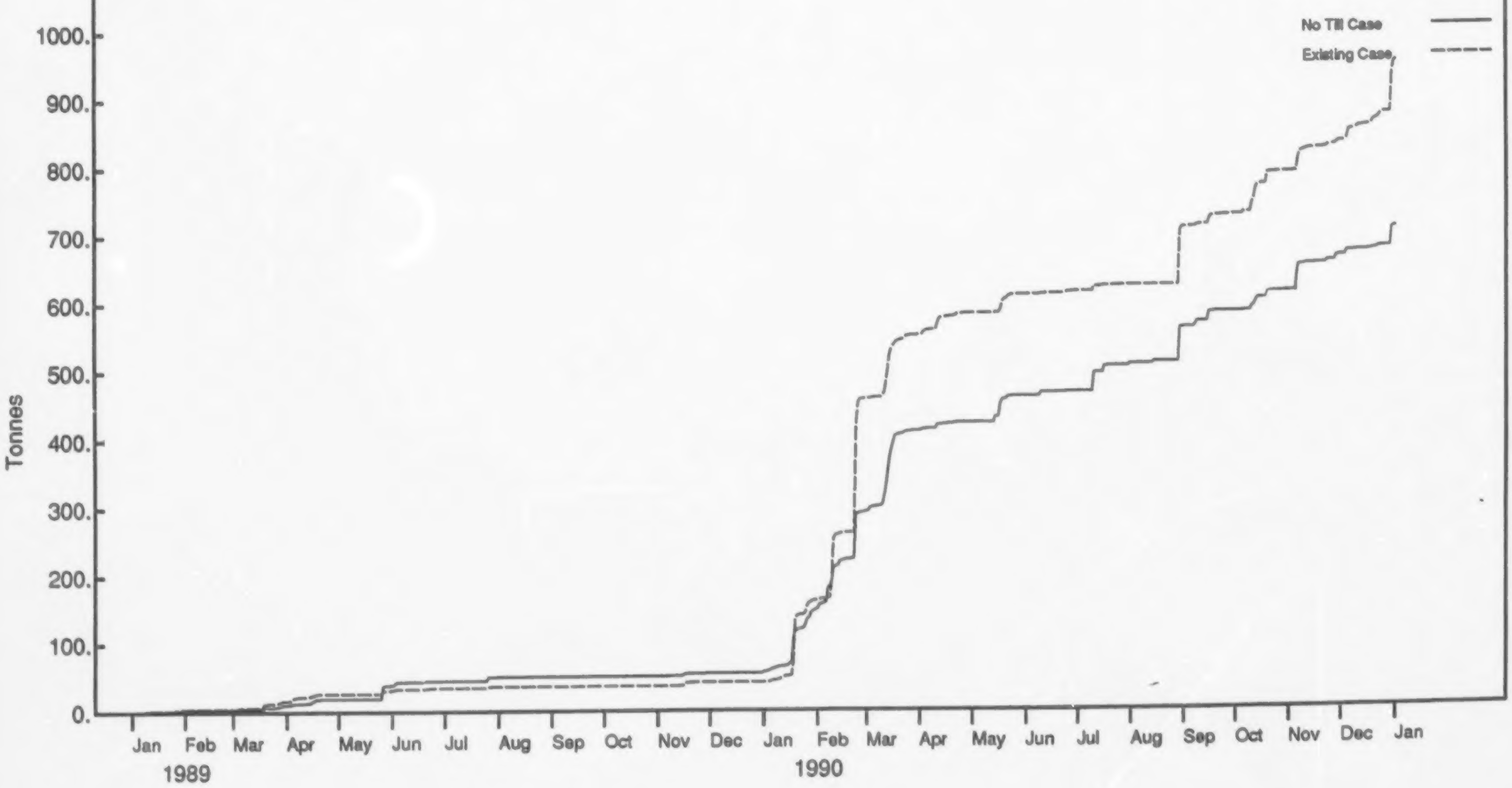


Figure 5.10: Kettle Creek Test Soil Loss, 1989 to 1990, No Till Case

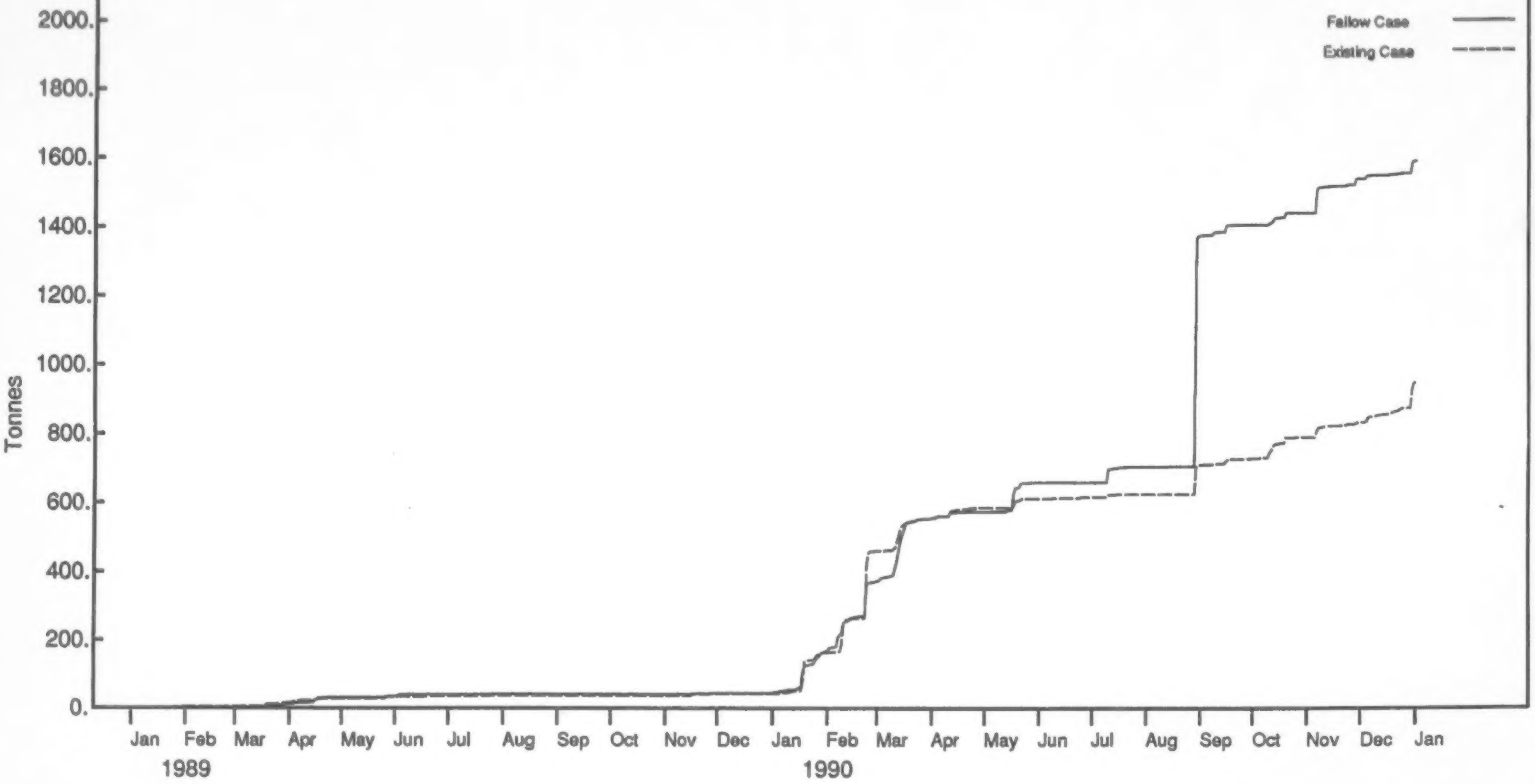


Figure 5.11: Kettle Creek Test Phosphorus Loss, 1989 to 1990, Fallow Case

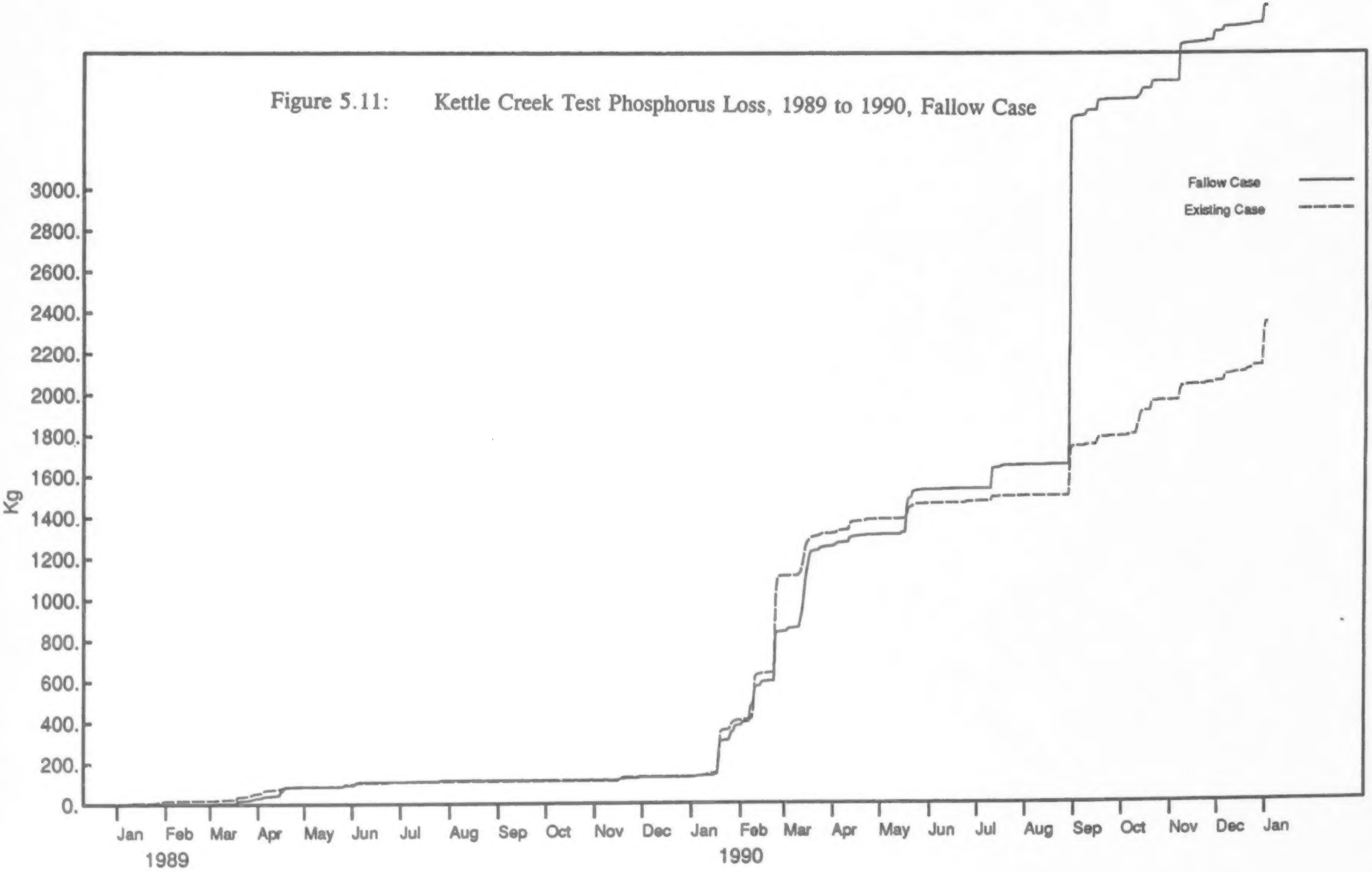


Figure 5.12: Kettle Creek Test Phosphorus Loss, 1989 to 1990, No Till Case

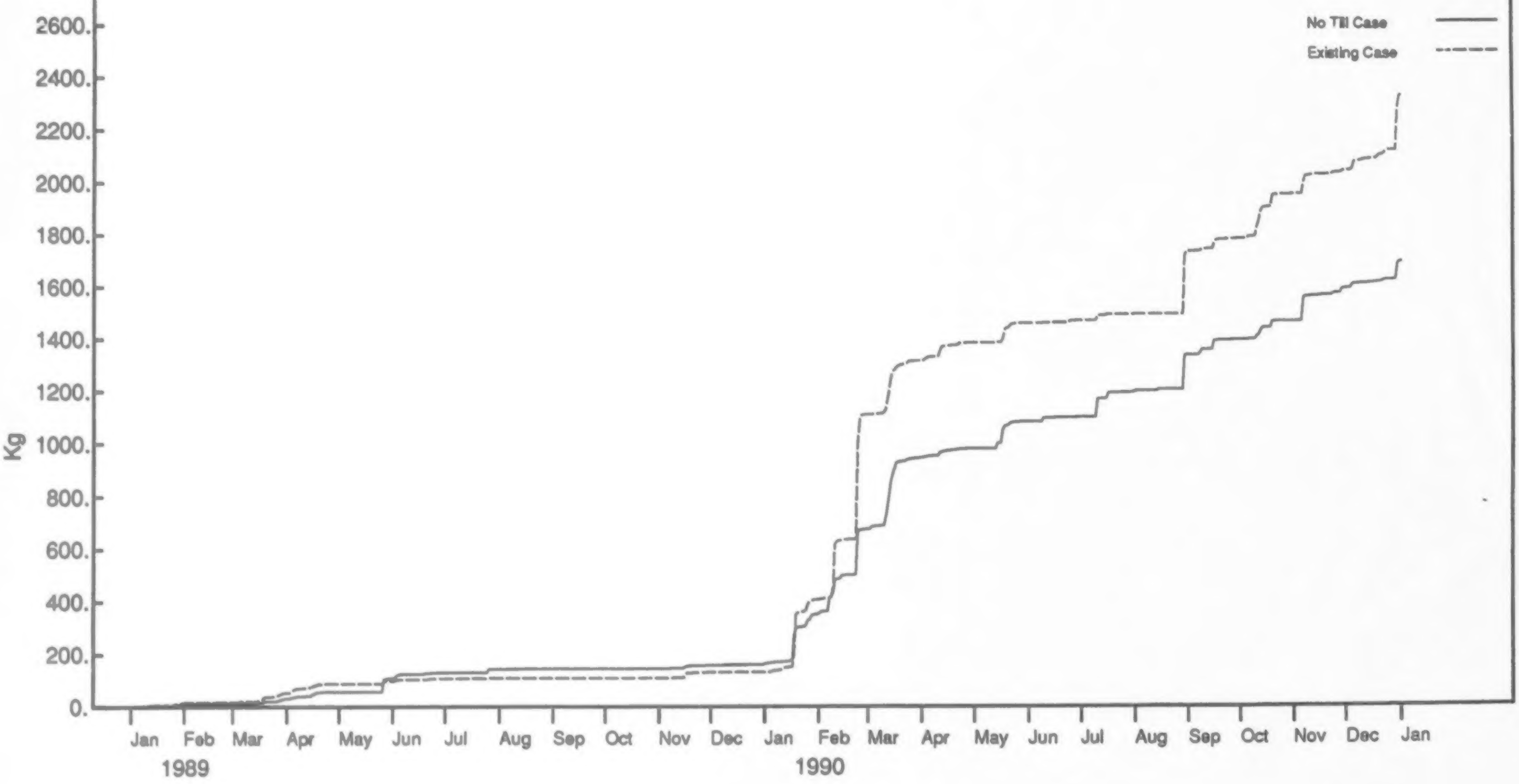
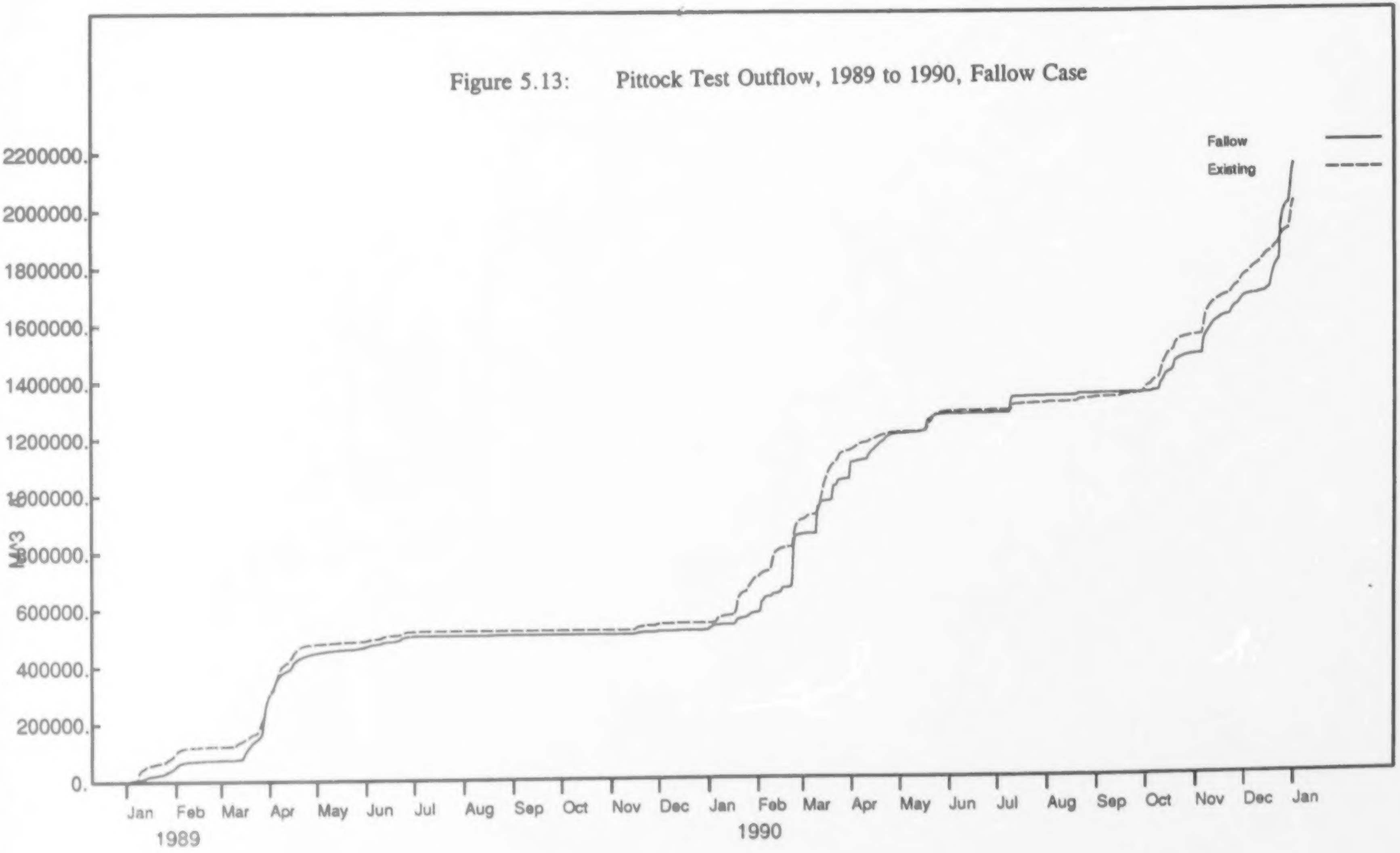


Figure 5.13: Pittock Test Outflow, 1989 to 1990, Fallow Case



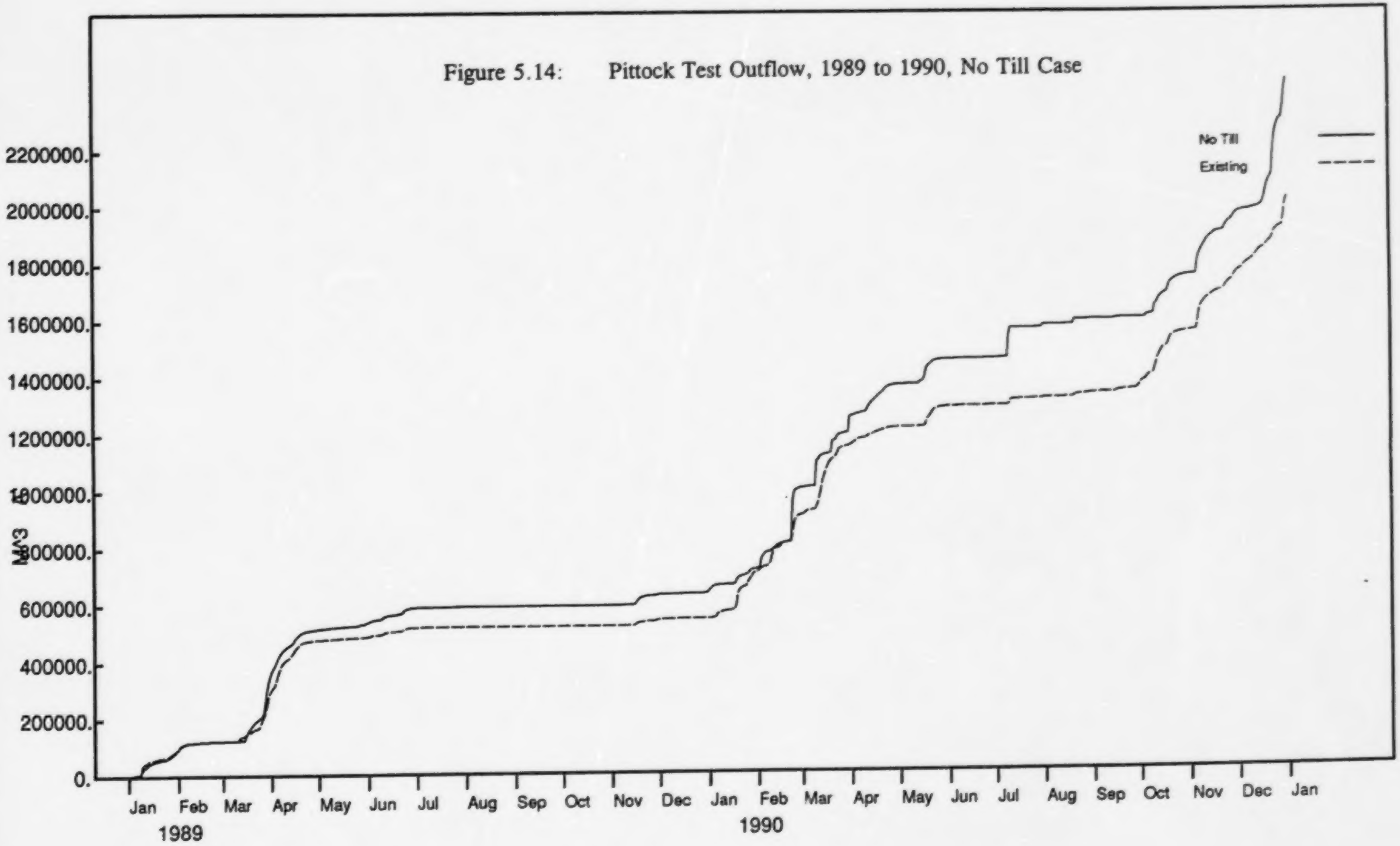
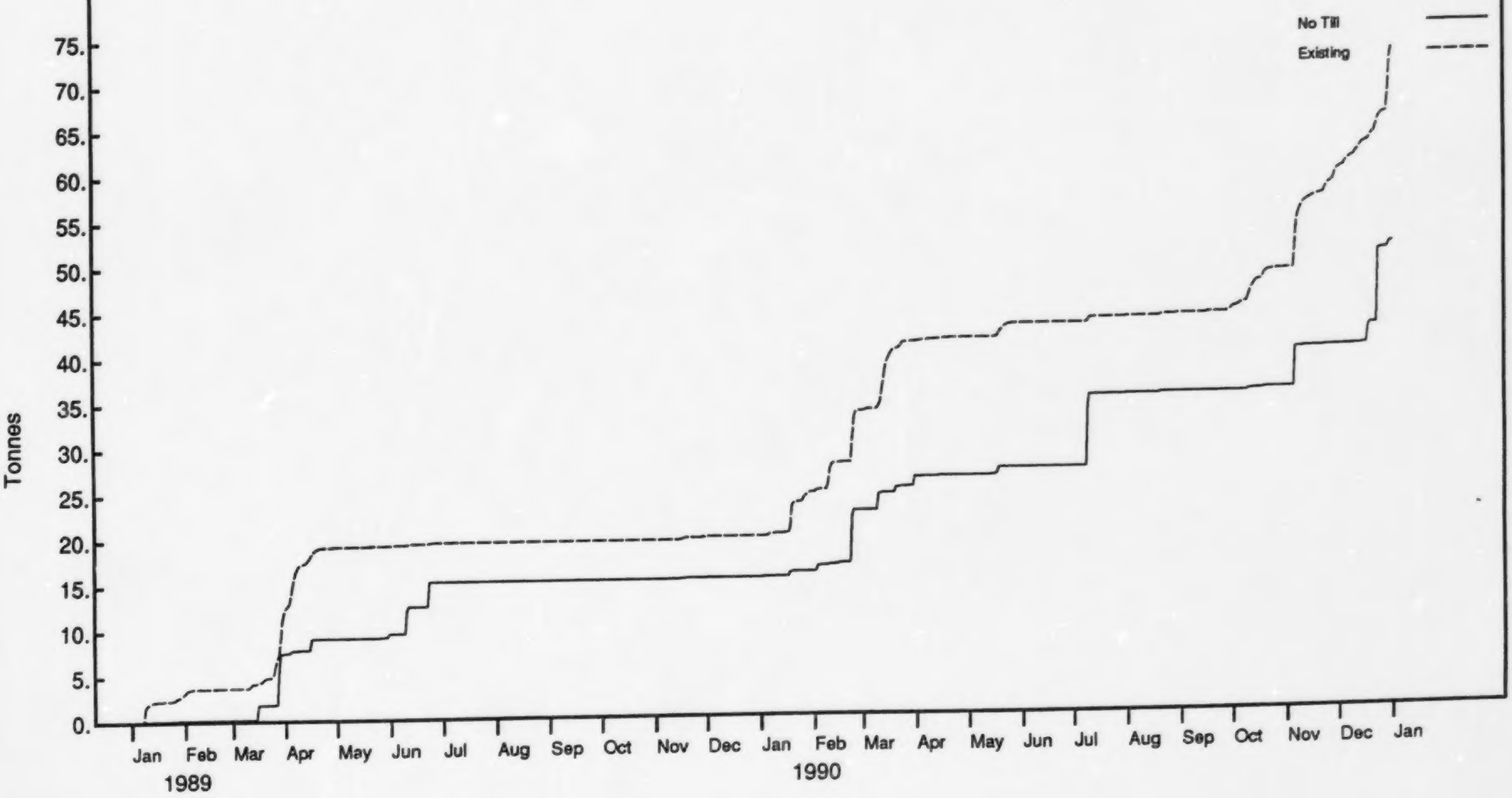


Figure 5.14: Pittock Test Outflow, 1989 to 1990, No Till Case

Figure 5.15: Pittock Test Soil Loss, 1989 to 1990, Fallow Case



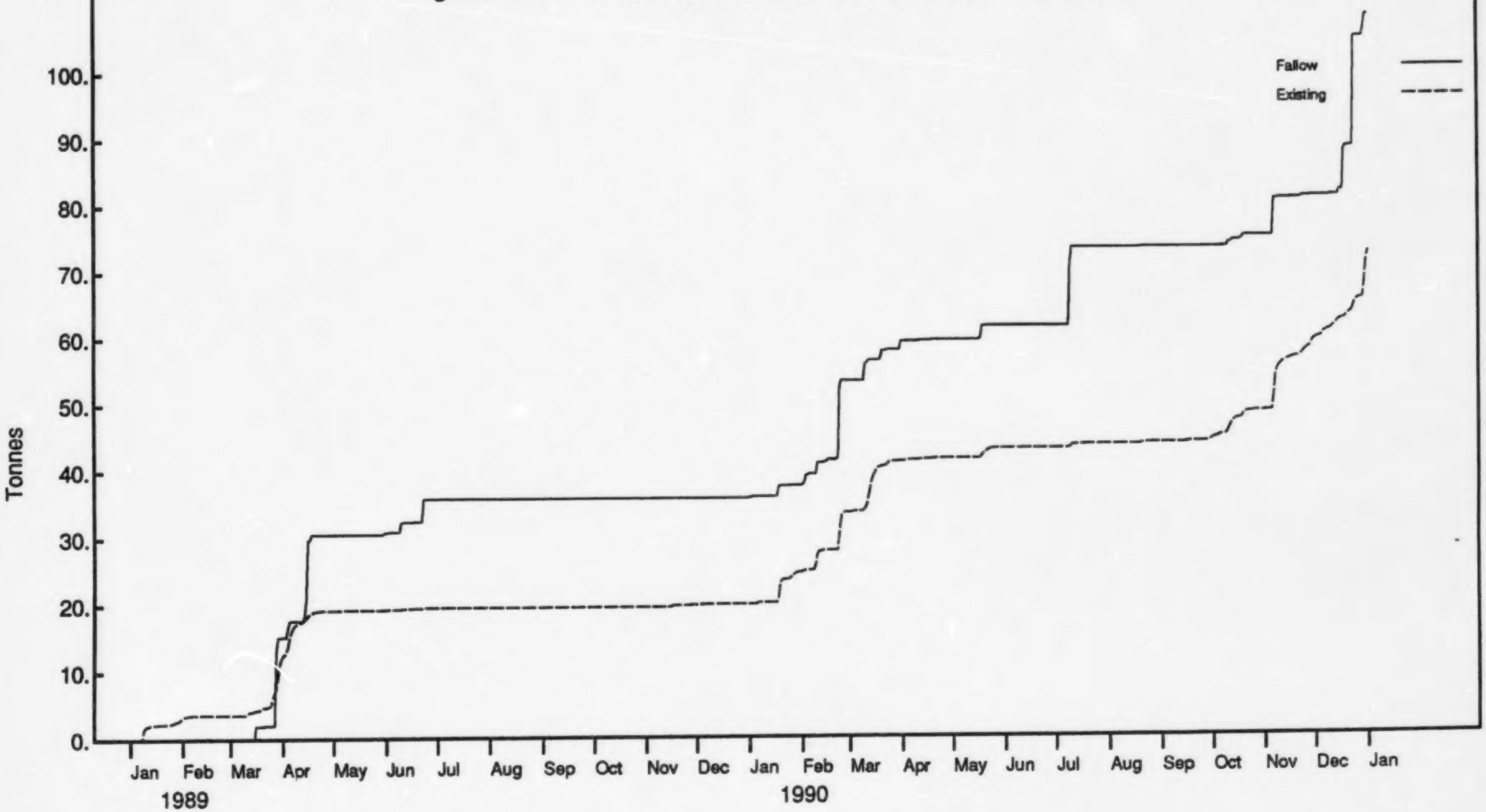


Figure 5.16: Pittock Test Soil Loss, 1989 to 1990, No Till Case

Figure 5.17: Pittock Test Phosphorus Loss, 1989 to 1990, Fallow Case

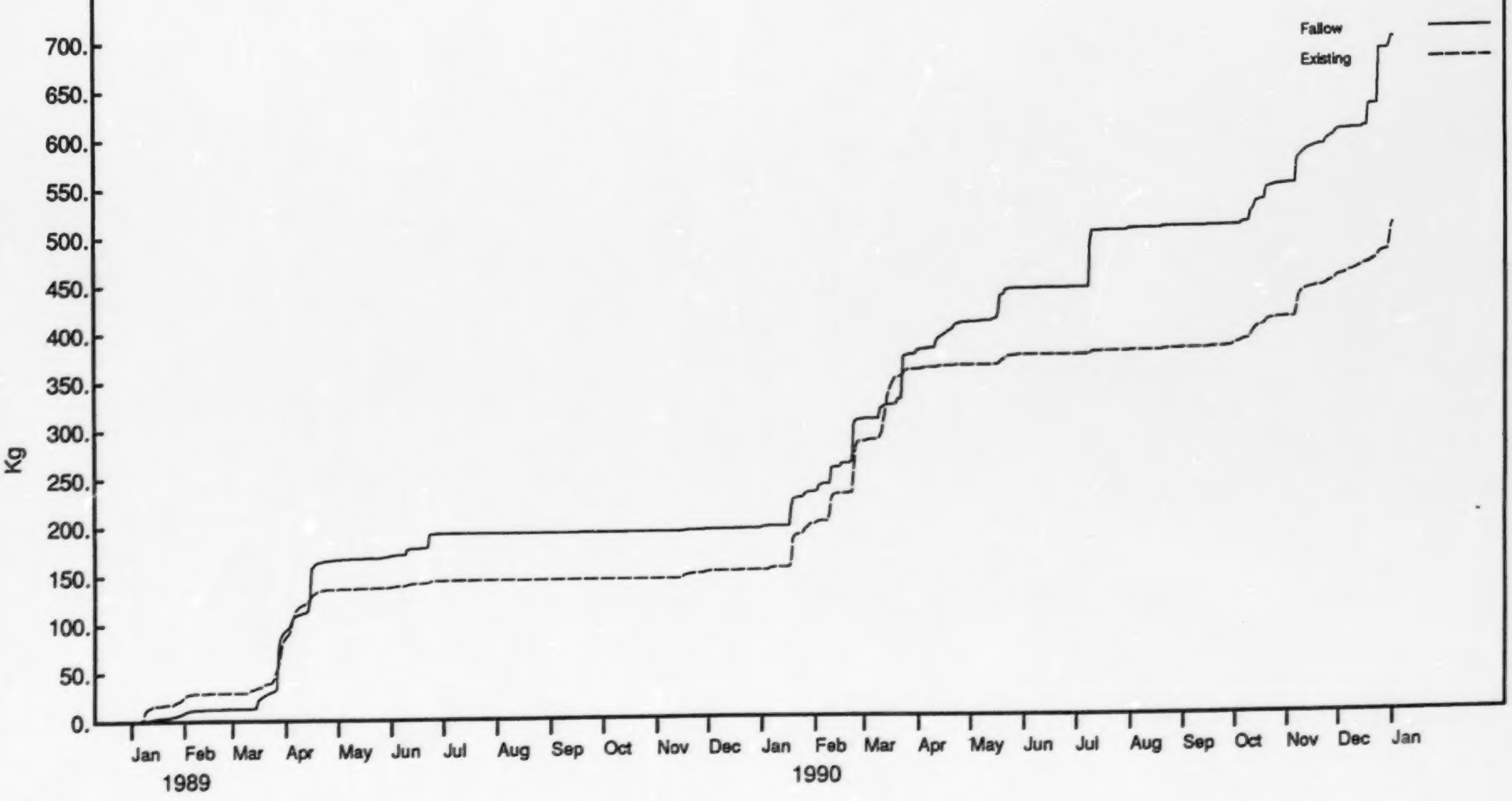
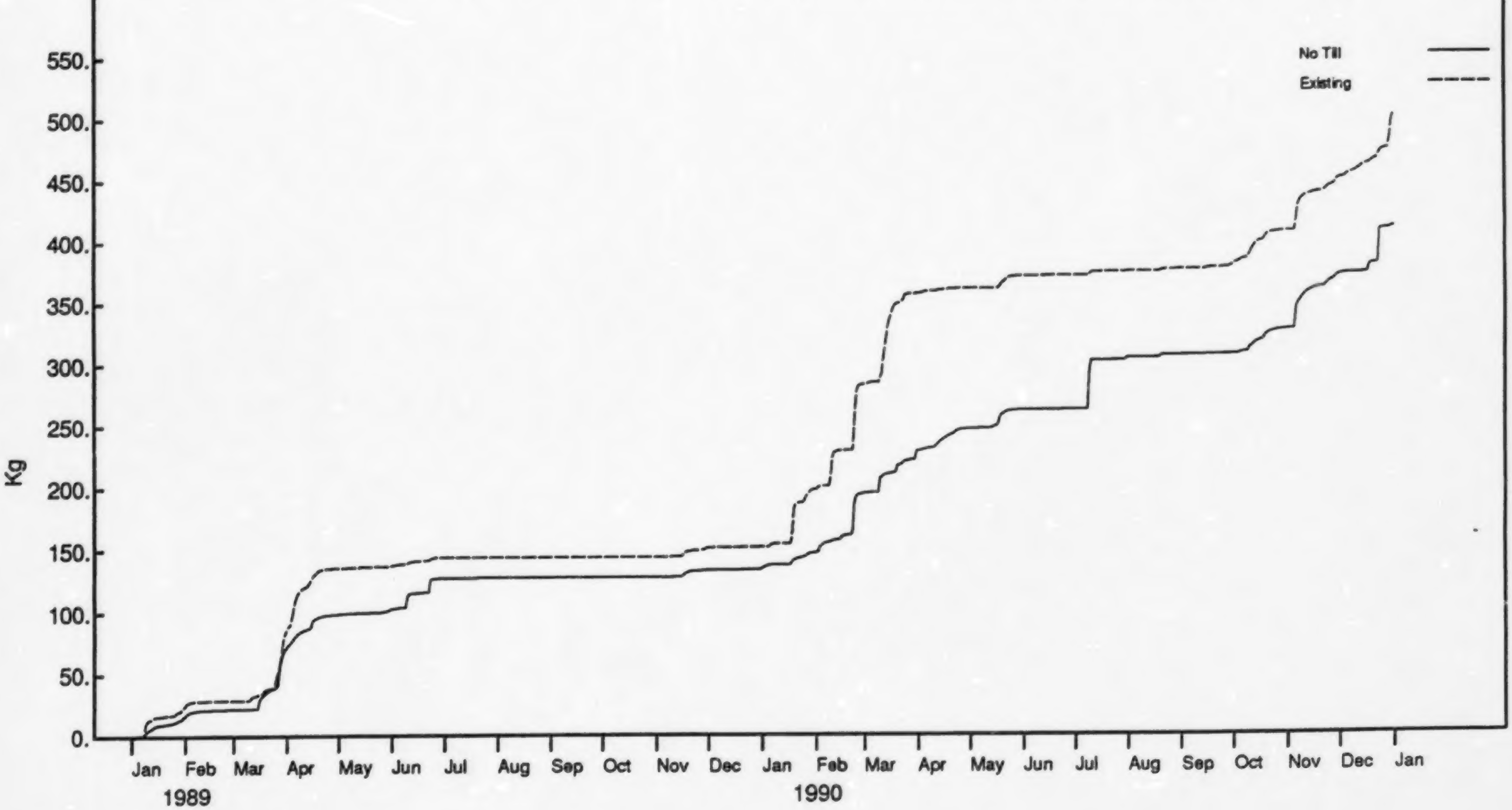


Figure 5.18: Pittock Test Phosphorus Loss, 1989 to 1990, No Till Case



APPENDIX A

Typical Input and Observed Data Files Used in Modelling

```
ittock Test Watershed, 1989 Games Run
1989 Real Conditions


ATERSHED AREA =  358.9 HECTARES.

UMBER OF CELLS =    275

ARIABLE PARAMETERS
******************

AINFALL FACTOR =  117.0

HYDROLOGIC COEF.S (PRIMARY - TERTIARY)  0.116 0.010 0.042 0.061 1.000
OIL EROD. FACTORS         .270 .310 .340 .370 .400 .430 .460
ROP FACTORS               .360 .050 .020 .100 .050 .340 .020 .300 .330
                          .220 .410 .300 .170 .250 .340 .300 .100 .020
                          .100 .020 .020 .400 .410 .300 .020 .440 .340
                          .340 .020 .100 .500 .320 .020 .020 .260 .410
                          .440 .020 .170 .020 .410 .100 .020 .340 .400
                          .320 .020 .020 .160 .130 .100 .100 .020 .050
                          .100 .020 .360 .020 .340 .410 .170 .020 .520
                          .420 .300 .020 .020 .100 .510 .510 .510 .510
                          .450 .240 .400 .020 .000 .000 .000 .000 .000
                          .000 .000 .000 .000 .000 .000 .000 .000 .000
                          .000 .000 .000 .000 .000 .000 .000 .000 .000
                          .000
URFACE ROUGHNESS         .014 .032 .032 .030 .046 .014 .032 .022 .024
                         .026 .014 .022 .028 .046 .028 .029 .046 .032
                         .046 .046 .046 .014 .014 .022 .032 .014 .028
                         .028 .032 .046 .014 .029 .032 .046 .030 .014
                         .014 .046 .028 .032 .014 .046 .032 .028 .014
                         .024 .046 .046 .030 .032 .024 .046 .032 .046
                         .046 .046 .021 .032 .028 .014 .030 .046 .014
                         .014 .018 .032 .032 .046 .014 .014 .014 .014
                         .014 .011 .014 .046 .000 .000 .000 .000 .000
                         .000 .000 .000 .000 .000 .000 .000 .000 .000
                         .000 .000 .000 .000 .000 .000 .000 .000 .000
                         .000


ELL PARAMETERS
**************

CELL   AREA   DISTANCE     C-FACTOR    K-FACTOR    LS-FACTOR    N-FACTOR    Hc VALUE
 NO.   (HA)   TO OUTLET
               (METRES)
----   ----   ---------    --------    --------    ---------    --------    --------
   1    1.2        877.       0.410       0.370        0.373       0.014       0.116
   2    0.5        863.       0.410       0.310        0.154       0.014       0.116
   3    0.5        779.       0.170       0.340        0.174       0.028       0.116
   4    0.4        709.       0.170       0.370        0.102       0.028       0.116
   5    0.4        765.       0.170       0.310        0.165       0.028       0.010
   6    0.8        807.       0.170       0.340        0.429       0.028       0.010
   7    1.0        807.       0.170       0.310        0.190       0.028       0.116
   8    0.5        821.       0.170       0.400        0.445       0.028       0.116
   9    8.4        789.       0.360       0.340        0.238       0.014       0.116
  10    0.4        545.       0.360       0.310        0.174       0.014       0.010
  11    2.1        695.       0.020       0.310        0.154       0.046       0.010
  12    1.5        485.       0.020       0.310        0.174       0.032       0.010
  13    4.8        569.       0.020       0.340        0.215       0.046       0.010
  14    1.2        639.       0.020       0.310        0.165       0.046       0.010
  15    1.8        261.       0.020       0.370        0.165       0.046       0.010
  16    0.7        787.       0.360       0.400        0.154       0.014       0.116
  17    1.3        475.       0.410       0.340        0.174       0.014       0.116
  18    0.9        731.       0.360       0.400        0.165       0.014       0.116
  19    2.6        323.       0.050       0.340        0.247       0.032       0.042
  20    4.0        321.       0.260       0.370        0.197       0.030       0.061
  21    0.7        391.       0.410       0.370        0.165       0.014       0.116
  22    1.0        195.       0.260       0.310        0.174       0.030       0.061
  23    1.3        275.       0.260       0.400        0.174       0.030       0.061
  24    8.0        435.       0.450       0.340        0.234       0.014       0.116
  25    0.6         57.       0.020       0.310        0.154       0.032       0.010
  26    2.1        384.       0.260       0.340        0.183       0.030       0.061
  27    1.3        195.       0.260       0.340        0.174       0.030       0.061
  28    0.5        491.       0.450       0.310        0.154       0.014       0.116
  29    3.3        821.       0.100       0.340        0.203       0.046       0.010
  30    0.4        181.       0.260       0.400        0.165       0.030       0.061
  31    4.0        561.       0.450       0.370        0.197       0.014       0.116
  32    1.1        492.       0.260       0.370        0.154       0.030       0.061
  33    2.7        691.       0.100       0.400        0.203       0.046       0.010
  34    6.8        479.       0.510       0.340        0.183       0.014       0.116
  35    0.8        884.       0.100       0.340        0.183       0.046       0.010
  36    0.5        884.       0.100       0.310        0.142       0.046       0.010
  37    1.7        549.       0.510       0.400        0.165       0.014       0.116
  38    0.4        842.       0.500       0.310        0.154       0.014       0.010
  39    9.4        786.       0.500       0.370        0.203       0.014       0.116
  40    9.0        241.       0.510       0.340        0.203       0.014       0.116
  41    0.7        870.       0.510       0.340        0.320       0.014       0.116
  42    0.5        828.       0.510       0.370        0.142       0.014       0.116
  43    0.9       1382.       0.510       0.340        0.429       0.014       0.116
  44    0.5       1301.       0.240       0.370        0.165       0.011       0.116
  45    0.9       1468.       0.240       0.340        0.165       0.011       0.116
  46    1.5        325.       0.510       0.370        0.174       0.014       0.116
  47    0.5       1398.       0.240       0.370        0.142       0.011       0.010
  48    0.9       1377.       0.020       0.340        0.154       0.032       0.010
  49    0.8       1270.       0.020       0.340        0.165       0.032       0.010
  50    0.6        814.       0.500       0.340        0.125       0.014       0.116
```

51	5.0	1200.	0.510	0.340	0.234	0.014	0.116
52	1.9	465.	0.510	0.340	0.174	0.014	0.116
53	0.5	1343.	0.400	0.400	0.165	0.014	0.010
54	0.5	507.	0.020	0.370	0.142	0.032	0.010
55	0.6	1315.	0.400	0.370	0.142	0.014	0.116
56	0.4	1273.	0.400	0.340	0.142	0.014	0.116
57	1.2	1230.	0.510	0.340	0.174	0.014	0.116
58	4.3	381.	0.100	0.340	0.203	0.046	0.010
59	5.2	395.	0.100	0.370	0.174	0.030	0.061
60	5.5	337.	0.100	0.370	0.197	0.046	0.010
61	0.9	856.	0.520	0.370	0.165	0.014	0.116
62	1.4	1129.	0.050	0.370	0.165	0.046	0.010
63	1.0	1059.	0.050	0.340	0.125	0.046	0.010
64	1.8	1075.	0.340	0.340	0.174	0.028	0.116
65	1.6	1183.	0.400	0.340	0.190	0.014	0.116
66	4.1	1094.	0.420	0.370	0.250	0.014	0.116
67	3.4	168.	0.400	0.340	0.394	0.014	0.010
68	0.7	814.	0.500	0.400	0.125	0.014	0.116
69	0.5	158.	0.100	0.340	0.142	0.046	0.010
70	0.7	884.	0.420	0.400	0.165	0.014	0.116
71	3.8	84.	0.320	0.340	0.174	0.024	0.061
72	3.4	878.	0.400	0.370	0.220	0.014	0.116
73	1.6	315.	0.020	0.340	0.220	0.032	0.010
74	2.1	963.	0.340	0.370	0.190	0.028	0.116
75	2.1	465.	0.050	0.370	0.165	0.046	0.010
76	1.2	921.	0.050	0.370	0.165	0.046	0.010
77	0.4	1031.	0.400	0.340	0.165	0.014	0.116
78	0.7	379.	0.300	0.400	0.183	0.018	0.116
79	0.5	133.	0.020	0.340	0.142	0.032	0.010
80	1.4	203.	0.100	0.340	0.190	0.046	0.010
81	3.7	679.	0.020	0.340	0.183	0.046	0.010
82	0.6	281.	0.500	0.340	0.165	0.014	0.116
83	1.9	379.	0.300	0.370	0.183	0.018	0.116
84	1.4	622.	0.410	0.460	0.154	0.014	0.116
85	4.0	523.	0.020	0.340	0.190	0.046	0.010
86	1.2	902.	0.410	0.340	0.165	0.014	0.116
87	1.3	505.	0.300	0.310	0.197	0.018	0.116
88	5.7	832.	0.440	0.370	0.197	0.014	0.116
89	1.6	748.	0.410	0.460	0.197	0.014	0.116
90	0.4	860.	0.410	0.370	0.125	0.014	0.116
91	1.9	930.	0.440	0.310	0.183	0.014	0.116
92	0.4	29.	0.020	0.370	0.125	0.032	0.010
93	4.0	283.	0.410	0.340	0.190	0.014	0.116
94	0.5	878.	0.340	0.400	0.154	0.028	0.010
95	2.6	822.	0.400	0.340	0.197	0.014	0.116
96	0.9	958.	0.340	0.340	0.125	0.028	0.116
97	0.5	423.	0.050	0.430	0.125	0.046	0.010
98	4.3	930.	0.440	0.340	0.183	0.014	0.116
99	1.2	921.	0.050	0.370	0.142	0.046	0.042
100	1.4	353.	0.410	0.370	0.165	0.014	0.116
101	1.1	538.	0.410	0.310	0.154	0.014	0.010
102	2.9	879.	0.100	0.370	0.238	0.024	0.061
103	0.9	501.	0.320	0.340	0.174	0.024	0.061
104	1.8	482.	0.410	0.400	0.154	0.014	0.116
105	1.4	427.	0.100	0.340	0.197	0.046	0.010
106	0.6	417.	0.020	0.340	0.154	0.046	0.010
107	0.6	551.	0.100	0.340	0.165	0.024	0.061
108	0.6	239.	0.020	0.400	0.125	0.046	0.010
109	1.3	277.	0.340	0.340	0.125	0.028	0.116
110	0.4	343.	0.360	0.370	0.190	0.021	0.116
111	0.5	267.	0.020	0.400	0.125	0.046	0.010
112	1.8	333.	0.020	0.370	0.197	0.046	0.010
113	1.5	281.	0.130	0.340	0.165	0.032	0.061
114	2.1	622.	0.440	0.310	0.165	0.014	0.116
115	0.7	413.	0.130	0.340	0.142	0.032	0.061
116	3.4	269.	0.410	0.400	0.183	0.014	0.116
117	1.7	695.	0.300	0.370	0.174	0.022	0.061
118	1.4	482.	0.440	0.340	0.154	0.014	0.116
119	2.5	371.	0.160	0.340	0.165	0.030	0.061
120	1.0	249.	0.360	0.340	0.142	0.021	0.116
121	0.4	523.	0.330	0.370	0.142	0.024	0.061
122	1.2	286.	0.410	0.370	0.165	0.014	0.116
123	0.9	779.	0.300	0.400	0.174	0.022	0.010
124	3.6	207.	0.020	0.340	0.197	0.046	0.010
125	1.9	382.	0.020	0.340	0.154	0.032	0.010
126	1.8	482.	0.440	0.310	0.154	0.014	0.116
127	0.9	452.	0.330	0.340	0.373	0.024	0.010
128	3.1	353.	0.300	0.340	0.190	0.022	0.061
129	0.5	438.	0.330	0.370	0.154	0.024	0.061
130	0.4	480.	0.300	0.400	0.125	0.022	0.061
131	5.9	824.	0.300	0.340	0.215	0.022	0.061
132	0.6	678.	0.340	0.310	0.154	0.028	0.116
133	0.8	156.	0.020	0.400	0.165	0.032	0.010
134	0.6	286.	0.410	0.310	0.165	0.014	0.116
135	0.8	552.	0.440	0.340	0.165	0.014	0.010
136	0.5	894.	0.300	0.370	0.165	0.022	0.061
137	0.7	371.	0.300	0.400	0.165	0.022	0.010
138	3.7	624.	0.440	0.340	0.183	0.014	0.116
139	0.9	371.	0.220	0.340	0.165	0.026	0.061
140	4.7	668.	0.330	0.340	0.220	0.024	0.061
141	3.4	313.	0.410	0.340	0.190	0.014	0.116
142	2.7	525.	0.020	0.340	0.234	0.046	0.010
143	0.8	395.	0.410	0.340	0.142	0.014	0.116
144	0.7	680.	0.440	0.310	0.154	0.014	0.116
145	0.6	770.	0.020	0.310	0.154	0.032	0.010
146	1.2	252.	0.020	0.340	0.197	0.032	0.010
147	2.1	507.	0.020	0.340	0.183	0.032	0.010
148	1.5	780.	0.340	0.340	0.174	0.028	0.116
149	0.8	357.	0.170	0.400	0.154	0.028	0.116
150	1.3	714.	0.020	0.340	0.183	0.032	0.010

51	3.6	431.	0.410	0.340	0.215	0.014	0.116
52	1.7	71.	0.170	0.340	0.165	0.028	0.116
53	3.1	697.	0.220	0.340	0.264	0.026	0.061
54	2.9	169.	0.250	0.340	0.183	0.046	0.010
55	6.0	409.	0.410	0.340	0.183	0.014	0.116
56	1.9	239.	0.340	0.340	0.165	0.028	0.116
57	1.3	602.	0.400	0.340	0.197	0.014	0.116
58	0.9	465.	0.340	0.340	0.154	0.028	0.116
59	2.9	729.	0.320	0.340	0.183	0.029	0.061
60	2.2	557.	0.410	0.310	0.197	0.014	0.010
61	2.5	99.	0.410	0.340	0.165	0.014	0.010
62	2.2	465.	0.400	0.340	0.154	0.014	0.116
63	1.0	29.	0.020	0.340	0.125	0.046	0.010
64	4.0	409.	0.300	0.340	0.183	0.022	0.116
65	1.4	922.	0.300	0.370	0.183	0.022	0.010
66	0.4	837.	0.020	0.340	0.154	0.032	0.010
67	2.7	113.	0.170	0.340	0.174	0.028	0.116
68	0.5	696.	0.330	0.370	0.125	0.024	0.010
69	1.7	519.	0.340	0.370	0.183	0.028	0.010
70	1.1	169.	0.250	0.340	0.154	0.046	0.010
71	3.2	253.	0.250	0.340	0.234	0.046	0.010
72	0.5	381.	0.300	0.370	0.125	0.022	0.116
73	5.5	421.	0.340	0.340	0.215	0.028	0.116
74	0.7	353.	0.300	0.310	0.142	0.022	0.010
75	1.8	263.	0.100	0.340	0.190	0.046	0.010
76	1.2	113.	0.100	0.340	0.174	0.046	0.010
77	0.5	71.	0.100	0.340	0.142	0.046	0.010
78	1.2	113.	0.100	0.340	0.165	0.046	0.010
79	0.5	43.	0.100	0.370	0.142	0.046	0.010
80	0.9	479.	0.400	0.310	0.349	0.014	0.116
81	0.5	57.	0.250	0.400	0.154	0.046	0.010
82	1.1	381.	0.410	0.370	0.165	0.014	0.116
83	0.7	423.	0.400	0.370	0.142	0.014	0.116
84	0.9	29.	0.020	0.340	0.125	0.046	0.010
85	1.2	71.	0.300	0.340	0.320	0.029	0.061
86	1.6	141.	0.100	0.340	0.373	0.046	0.010
87	0.4	519.	0.170	0.340	0.183	0.030	0.061
88	1.0	687.	0.170	0.370	0.215	0.030	0.061
89	1.3	395.	0.170	0.340	0.394	0.030	0.061
90	1.3	453.	0.170	0.370	0.190	0.030	0.061
91	0.9	381.	0.170	0.270	0.165	0.030	0.061
92	3.2	311.	0.170	0.310	0.459	0.030	0.061
93	0.7	437.	0.170	0.400	0.349	0.030	0.061
94	1.5	169.	0.340	0.310	0.190	0.014	0.116
95	0.8	57.	0.340	0.400	0.154	0.014	0.116
96	0.5	291.	0.340	0.310	0.142	0.014	0.116
97	1.0	249.	0.340	0.400	0.394	0.014	0.010
98	2.8	183.	0.020	0.400	0.220	0.046	0.010
99	0.9	165.	0.340	0.310	0.174	0.014	0.116
00	1.5	165.	0.340	0.340	0.174	0.014	0.116
01	0.5	253.	0.020	0.370	0.165	0.046	0.010
02	0.5	587.	0.440	0.340	0.190	0.014	0.116
03	0.4	1482.	0.020	0.340	0.197	0.032	0.010
04	0.0	661.	0.020	0.400	0.113	0.046	0.010
05	0.0	551.	0.020	0.340	0.106	0.046	0.010
06	0.0	461.	0.020	0.340	0.094	0.046	0.010
07	0.0	401.	0.020	0.370	0.137	0.046	0.010
08	0.0	191.	0.260	0.400	0.133	0.030	0.061
09	0.0	111.	0.020	0.340	0.113	0.046	0.010
10	0.0	286.	0.020	0.400	0.130	0.046	0.010
11	0.0	436.	0.020	0.340	0.124	0.046	0.010
12	0.0	681.	0.510	0.340	0.118	0.014	0.116
13	0.0	211.	0.450	0.340	0.137	0.014	0.116
14	0.0	551.	0.510	0.340	0.133	0.014	0.116
15	0.0	381.	0.510	0.340	0.154	0.014	0.116
16	0.0	101.	0.510	0.340	0.117	0.014	0.116
17	0.0	241.	0.100	0.340	0.125	0.046	0.010
18	0.0	116.	0.100	0.340	0.122	0.046	0.010
19	0.0	211.	0.100	0.370	0.146	0.046	0.010
20	0.0	646.	0.500	0.370	0.182	0.014	0.116
21	0.0	203.	0.100	0.340	0.125	0.024	0.061
22	0.0	91.	0.100	0.340	0.117	0.024	0.061
23	0.0	566.	0.020	0.340	0.160	0.046	0.010
24	0.0	411.	0.020	0.340	0.173	0.046	0.010
25	0.0	361.	0.020	0.400	0.136	0.046	0.010
26	0.0	581.	0.320	0.340	0.148	0.024	0.061
27	0.0	976.	0.320	0.340	0.177	0.024	0.061
28	0.0	586.	0.400	0.340	0.149	0.014	0.116
29	0.0	696.	0.400	0.340	0.120	0.014	0.116
230	0.0	851.	0.340	0.400	0.133	0.028	0.116
231	0.0	961.	0.340	0.370	0.116	0.028	0.116
232	0.0	1071.	0.400	0.370	0.116	0.014	0.116
233	0.0	991.	0.020	0.340	0.125	0.046	0.010
234	0.0	1146.	0.020	0.340	0.129	0.046	0.010
235	0.0	1321.	0.020	0.340	0.134	0.046	0.010
236	0.0	1031.	0.020	0.370	0.135	0.046	0.010
237	0.0	1231.	0.020	0.370	0.139	0.046	0.010
238	0.0	1356.	0.020	0.370	0.121	0.046	0.010
239	0.0	211.	0.020	0.340	0.123	0.046	0.010
240	0.0	171.	0.020	0.400	0.189	0.046	0.010
241	0.0	301.	0.020	0.340	0.256	0.032	0.010
242	0.0	86.	0.020	0.400	0.175	0.032	0.010
243	0.0	216.	0.020	0.400	0.199	0.046	0.010
244	0.0	426.	0.410	0.310	0.202	0.014	0.116
245	0.0	706.	0.440	0.400	0.220	0.014	0.116
246	0.0	426.	0.020	0.340	0.230	0.046	0.010
247	0.0	526.	0.020	0.340	0.184	0.046	0.010
248	0.0	616.	0.020	0.340	0.203	0.046	0.010
249	0.0	696.	0.020	0.340	0.172	0.046	0.010
250	0.0	781.	0.020	0.340	0.208	0.046	0.010

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 51    0.0       631.      0.020       0.340       0.210      0.046      0.010
 52    0.0       476.      0.020       0.340       0.293      0.046      0.010
 53    0.0       241.      0.020       0.400       0.239      0.046      0.010
254    0.0       481.      0.020       0.340       0.239      0.046      0.010
255    0.0       611.      0.020       0.370       0.175      0.046      0.010
 56    0.0       641.      0.100       0.370       0.186      0.024      0.061
 57    0.0       301.      0.020       0.400       0.256      0.046      0.010
 58    0.0       201.      0.410       0.340       0.226      0.014      0.116
259    0.0       326.      0.410       0.340       0.197      0.014      0.116
260    0.0       671.      0.410       0.340       0.237      0.014      0.116
261    0.0       311.      0.300       0.340       0.227      0.022      0.116
 62    0.0       341.      0.170       0.310       0.189      0.030      0.061
 63    0.0       171.      0.170       0.310       0.189      0.030      0.061
264    0.0        81.      0.340       0.340       0.151      0.014      0.116
265    0.0       151.      0.100       0.340       0.159      0.046      0.010
266    0.0       361.      0.220       0.340       0.176      0.026      0.061
 67    0.0       486.      0.330       0.340       0.150      0.024      0.061
 68    0.0       656.      0.300       0.340       0.165      0.022      0.061
 69    0.0       126.      0.020       0.340       0.150      0.046      0.010
270    0.0        81.      0.020       0.340       0.131      0.046      0.010
271    0.0       231.      0.020       0.340       0.159      0.046      0.010
272    0.0       391.      0.360       0.370       0.139      0.021      0.116
 73    0.0       311.      0.100       0.370       0.164      0.030      0.061
 74    0.0       461.      0.100       0.370       0.132      0.030      0.061
275    0.0         1.      0.000       0.310       0.041      0.000      1.000


THE TOTAL POTENTIAL SOIL LOSS -     1886.8 TONNES:
THE AVERAGE EROSION -     5.3 TONNES/HA

SUMMARY OF CELL POTENTIAL SOIL LOSS AND SEDIMENT VALUES
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ELL  AREA  CELL D/R    CELL D/R      SED RATE  SED DEL   SOIL LOSS  POT.SO.LOSS
NO.         TO STM   TO ADJ CELL     TO STM    TO STM
----  -HA-  --------   ------------  -TON/HA-  TONNES-   --TON/HA-  --TONNES--
   1   1.2  0.0024       0.6176        0.035    0.040     14.839      17.07
   2   0.5  0.0024       0.4719        0.012    0.006      5.151       2.68
   3   0.5  0.0024       0.1949        0.006    0.003      2.645       1.40
   4   0.4  0.0024       0.8242        0.004    0.002      1.682       0.72
   5   0.4  0.0024       0.0314        0.005    0.002      2.284       0.94
   6   0.8  0.0024       0.0337        0.015    0.013      6.510       5.34
   7   1.0  0.0024       0.1547        0.006    0.006      2.629       2.63
   8   0.5  0.0024       0.2203        0.019    0.010      7.935       4.21
   9   8.4  0.0021       0.1473        0.016    0.137      7.657      64.25
  10   0.4  0.0026       0.0474        0.013    0.006      5.1C8       2.20
  11   2.1  0.0024       0.0252        0.001    0.001      0.251       0.52
  12   1.5  C.0030       0.0244        0.001    0.001      0.284       0.[illegible]
  13   4.8  0.0027       0.0104        0.001    0.005      0.383       1.8[illegible]
  14   1.2  0.0025       0.0211        0.001    0.001      0.269       0.3[illegible]
  15   1.8  0.0125       0.0211        0.004    0.007      0.321       0.5[illegible]
  16   0.7  0.0017       0.4719        0.010    0.007      5.836       4.2[illegible]
  17   1.3  0.0055       0.3405        0.035    0.044      6.380       8.04
  18   0.9  0.0017       0.3943        0.011    0.009      6.240       5.43
  19   2.6  0.0184       0.0306        0.020    0.053      1.100       2.90
  20   4.0  0.0055       0.0793        0.027    0.110      4.972      19.99
  21   0.7  0.0055       0.3943        0.036    0.025      6.574       4.60
  22   1.0  0.0057       0.1100        0.021    0.022      3.689       3.84
  23   1.3  0.0203       0.1100        0.097    0.124      4.760       6.09
  24   8.0  0.0511       0.1547        0.480    3.844      9.398      75.29
  25   0.6  0.0338       0.0338        0.008    0.005      0.251       0.14
  26   2.1  0.0027       0.0971        0.011    0.023      4.237       8.77
  27   1.3  0.0057       0.1100        0.023    0.030      4.046       5.22
  28   0.5  0.0486       0.4719        0.275    0.146      5.653       3.00
  29   3.3  0.0096       0.0121        0.017    0.058      1.814       6.02
  30   0.4  0.0057       0.1273        0.026    0.011      4.507       1.94
  31   4.0  0.0459       0.2457        0.395    1.560      8.606      34.00
  32   1.1  0.0019       0.1524        0.007    0.008      3.899       4.17
  33   2.7  0.0100       0.0121        0.021    0.058      2.134       5.76
  34   6.8  0.0448       0.3008        0.372    2.518      8.312      56.20
  35   0.8  0.0038       0.0161        0.006    0.005      1.630       1.29
  36   0.5  0.0040       0.0318        0.005    0.002      1.152       0.56
  37   1.7  0.0425       0.3943        0.376    0.643      8.840      15.12
  38   0.4  0.0042       0.0657        0.027    0.011      6.282       2.58
  39   9.4  0.0043       0.2258        0.043    0.403      9.869      92.79
  40   9.0  0.1047       0.2258        0.969    8.702      9.251      83.08
  41   0.7  0.0043       0.9315        0.063    0.042     14.552       9.61
  42   0.5  0.0043       0.5948        0.030    0.016      7.015       3.65
  43   0.9  0.0032       0.4231        0.063    0.058     19.531      17.97
  44   0.5  0.0017       0.4788        0.007    0.004      3.848       2.08
  45   0.9  0.0015       0.4788        0.005    0.005      3.536       3.11
  46   1.5  0.0886       0.3405        0.765    1.125      8.637      12.70
  47   0.5  0.0015       0.1005        0.005    0.002      3.301       1.55
  48   0.9  0.0015       0.0338        0.000    0.000      0.276       0.24
  49   0.8  0.0032       0.0282        0.001    0.001      0.295       0.24
  50   0.6  0.0043       0.8242        0.024    0.014      5.596       3.30
  51   5.0  0.0034       0.1547        0.037    0.182     10.651      53.05
  52   1.9  0.0034       0.3405        0.027    0.050      7.936      14.84
  53   0.5  0.0017       0.0549        0.012    0.006      6.933       3.54
  54   0.5  0.0033       0.0426        0.001    0.000      0.275       0.14
  55   0.6  0.0017       0.5948        0.010    0.006      5.502       3.25
  56   0.4  0.0017       0.5948        0.009    0.004      5.056       2.17
  57   1.2  0.0020       0.3405        0.016    0.018      7.936       9.37
  58   4.3  0.0034       0.0121        0.006    0.027      1.814       7.86
  59   5.2  0.0184       0.1100        0.031    0.160      1.693       8.72
  60   5.5  0.0038       0.0131        0.007    0.040      1.912      10.52
  61   0.9  0.0043       0.3943        0.036    0.031      8.337       7.09
  62   1.4  0.0022       0.0211        0.002    0.002      0.802       1.08
  63   1.0  0.0023       0.0440        0.001    0.001      0.560       0.57
  64   1.8  0.0026       0.1949        0.014    0.025      5.291       9.52
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65	1.6	0.0037	0.2701	0.025	0.041	6.786	11.06
66	4.1	0.0043	0.1292	0.044	0.179	10.207	41.75
67	3.4	0.0000	0.0742	0.000	0.000	14.052	48.06
68	0.7	0.0043	0.8242	0.029	0.020	6.584	4.54
69	0.5	0.0065	0.0318	0.008	0.004	1.264	0.67
70	0.7	0.0043	0.3943	0.031	0.022	7.280	5.10
71	3.8	0.0000	0.1316	0.000	0.000	4.980	19.07
72	3.4	0.0039	0.1828	0.033	0.112	8.542	28.71
73	1.6	0.0103	0.0131	0.004	0.006	0.392	0.63
74	2.1	0.0038	0.1547	0.024	0.050	6.277	12.99
75	2.1	0.0112	0.0211	0.009	0.019	0.802	1.68
76	1.2	0.0035	0.0211	0.003	0.003	0.802	0.92
77	0.4	0.0038	0.3943	0.022	0.010	5.893	2.59
78	0.7	0.0045	0.2457	0.026	0.017	5.752	3.80
79	0.5	0.0303	0.0426	0.008	0.004	0.253	0.12
80	1.4	0.0130	0.0144	0.022	0.030	1.696	2.34
81	3.7	0.0034	0.0161	0.001	0.004	0.326	1.20
82	0.6	0.0045	0.3943	0.033	0.020	7.367	4.42
83	1.9	0.0045	0.2457	0.024	0.045	5.321	10.00
84	1.4	0.0031	0.4719	0.024	0.034	7.643	10.86
85	4.0	0.0036	0.0144	0.001	0.005	0.339	1.35
86	1.2	0.0087	0.3943	0.053	0.064	6.041	7.31
87	1.3	0.0045	0.2007	0.022	0.028	4.807	6.35
88	5.7	0.0088	0.2457	0.074	0.424	8.415	48.14
89	1.6	0.0031	0.2457	0.030	0.049	9.748	15.79
90	0.4	0.0088	0.8242	0.044	0.019	4.994	2.20
91	1.9	0.0087	0.3008	0.057	0.109	6.538	12.56
92	0.4	0.0590	0.0590	0.014	0.005	0.244	0.09
93	4.0	0.0091	0.2701	0.063	0.255	6.955	28.03
94	0.5	0.0037	0.0376	0.021	0.010	5.512	2.65
95	2.6	0.0039	0.2457	0.028	0.073	7.030	18.56
96	0.9	0.0087	0.4719	0.033	0.029	3.805	3.39
97	0.5	0.0145	0.0440	0.010	0.005	0.708	0.33
98	4.3	0.0087	0.3008	0.062	0.271	7.171	31.13
99	1.2	0.0042	0.1008	0.003	0.003	0.688	0.79
100	1.4	0.0090	0.3943	0.059	0.082	6.574	9.07
101	1.1	0.0086	0.0657	0.044	0.050	5.151	5.82
102	2.9	0.0042	0.0569	0.010	0.029	2.315	6.78
103	0.9	0.0037	0.1316	0.018	0.017	4.980	4.53
104	1.8	0.0092	0.4719	0.061	0.108	6.646	11.83
105	1.4	0.0060	0.0131	0.011	0.015	1.757	2.50
106	0.6	0.0037	0.0252	0.001	0.001	0.276	0.17
107	0.6	0.0044	0.1524	0.007	0.004	1.473	0.81
108	0.6	0.0071	0.0440	0.002	0.001	0.263	0.14
109	1.3	0.0078	0.4719	0.030	0.037	3.805	4.76
110	0.4	0.0061	0.1949	0.040	0.017	6.646	2.79
111	0.5	0.0066	0.0440	0.002	0.001	0.263	0.14
112	1.8	0.0056	0.0131	0.002	0.004	0.382	0.69
113	1.5	0.0076	0.1209	0.014	0.022	1.915	2.95
114	2.1	0.0084	0.3943	0.050	0.103	5.911	12.24
115	0.7	0.0084	0.1823	0.014	0.010	1.643	1.22
116	3.4	0.0091	0.3008	0.072	0.242	7.861	26.58
117	1.7	0.0036	0.1411	0.018	0.031	5.080	8.74
118	1.4	0.0092	0.4719	0.056	0.079	6.063	8.61
119	2.5	0.0085	0.1273	0.020	0.050	2.357	5.87
120	1.0	0.0078	0.4292	0.035	0.034	4.550	4.37
121	0.4	0.0044	0.2298	0.020	0.009	4.539	1.95
122	1.2	0.0094	0.3943	0.062	0.075	6.574	7.96
123	0.9	0.0034	0.0329	0.019	0.016	5.492	4.67
124	3.6	0.0078	0.0131	0.003	0.010	0.351	1.25
125	1.9	0.0288	0.0338	0.008	0.015	0.276	0.52
126	1.8	0.0092	0.4719	0.051	0.092	5.528	10.06
127	0.9	0.0215	0.0557	0.236	0.200	10.976	9.33
128	3.1	0.0076	0.1120	0.039	0.121	5.089	15.98
129	0.5	0.0267	0.1823	0.132	0.059	4.948	2.23
130	0.4	0.0209	0.3416	0.083	0.036	3.950	1.70
131	5.9	0.0068	0.0808	0.039	0.231	5.747	34.03
132	0.6	0.0083	0.2701	0.035	0.022	4.272	2.65
133	0.8	0.0149	0.0282	0.005	0.004	0.347	0.28
134	0.6	0.0094	0.3943	0.052	0.030	5.508	3.19
135	0.8	0.0084	0.0549	0.055	0.046	6.483	5.45
136	0.5	0.0067	0.1634	0.032	0.015	4.810	2.31
137	0.7	0.0060	0.0381	0.031	0.022	5.200	3.59
138	3.7	0.0043	0.3008	0.031	0.116	7.171	26.82
139	0.9	0.0064	0.1429	0.021	0.019	3.241	2.95
140	4.7	0.0071	0.0706	0.046	0.217	6.476	30.51
141	3.4	0.1185	0.2701	0.824	2.835	6.955	23.93
142	2.7	0.0042	0.0083	0.002	0.005	0.418	1.14
143	0.8	0.0076	0.5948	0.039	0.032	5.182	4.25
144	0.7	0.0043	0.4719	0.024	0.016	5.528	3.76
145	0.6	0.0032	0.0338	0.001	0.001	0.251	0.16
146	1.2	0.0072	0.0176	0.003	0.003	0.351	0.43
147	2.1	0.0179	0.0215	0.006	0.012	0.326	0.67
148	1.5	0.0033	0.1949	0.017	0.027	5.291	8.04
149	0.8	0.0065	0.2701	0.018	0.015	2.756	2.29
150	1.3	0.0034	0.0215	0.001	0.001	0.326	0.41
151	3.6	0.0061	0.1949	0.048	0.170	7.855	28.05
152	1.7	0.2258	0.2258	0.565	0.978	2.505	4.33
153	3.1	0.0071	0.0404	0.037	0.115	5.189	16.19
154	2.9	0.0156	0.0161	0.064	0.185	4.074	11.86
155	6.0	0.0648	0.3008	0.433	2.576	6.682	39.76
156	1.9	0.0152	0.2258	0.076	0.141	5.009	9.32
157	1.3	0.0045	0.2457	0.032	0.041	7.030	9.07
158	0.9	0.0540	0.2701	0.253	0.228	4.685	4.22
159	2.9	0.0036	0.0998	0.019	0.054	5.215	15.13
160	2.2	0.0056	0.0342	0.037	0.080	6.570	14.32
161	2.5	0.0279	0.0549	0.169	0.422	6.041	15.10
162	2.2	0.0607	0.4719	0.334	0.726	5.512	11.96
163	1.0	0.0440	0.0440	0.010	0.010	0.224	0.23
164	4.0	0.0607	0.2091	0.297	1.172	4.889	19.32

165	1.4	0.0060	0.0291	0.032	0.043	5.321	7.18
166	0.4	0.0029	0.0338	0.001	0.000	0.276	0.12
167	2.7	0.0392	0.1949	0.104	0.280	2.645	7.14
168	0.5	0.0068	0.0743	0.027	0.013	4.019	1.85
169	1.7	0.0062	0.0240	0.037	0.064	6.030	10.37
170	1.1	0.0175	0.0252	0.060	0.066	3.445	3.76
171	3.2	0.0075	0.0083	0.039	0.126	5.221	16.82
172	0.5	0.0360	0.5729	0.131	0.059	3.654	1.64
173	5.5	0.0073	0.1116	0.048	0.260	6.514	35.57
174	0.7	0.0369	0.0575	0.128	0.089	3.457	2.42
175	1.8	0.0061	0.0144	0.010	0.018	1.696	3.00
176	1.2	0.0144	0.0182	0.022	0.027	1.556	1.90
177	0.5	0.0211	0.0318	0.027	0.012	1.264	0.58
178	1.2	0.0144	0.0211	0.021	0.026	1.473	1.81
179	0.5	0.0318	0.0318	0.044	0.021	1.376	0.67
180	0.9	0.0614	0.7390	0.696	0.620	11.344	10.10
181	0.5	0.0252	0.0252	0.102	0.047	4.053	1.86
182	1.1	0.0671	0.3943	0.441	0.472	6.574	7.03
183	0.7	0.0637	0.5948	0.351	0.242	5.502	3.80
184	0.9	0.0440	0.0440	0.010	0.009	0.224	0.21
185	1.2	0.0411	0.3091	0.352	0.426	8.560	10.36
186	1.6	0.0209	0.0330	0.070	0.108	3.326	5.16
187	0.4	0.0071	0.0971	0.020	0.008	2.771	1.19
188	1.0	0.0067	0.0630	0.024	0.025	3.544	3.69
189	1.3	0.0371	0.1722	0.221	0.279	5.972	7.53
190	1.3	0.0260	0.0872	0.082	0.104	3.138	4.02
191	0.9	0.0352	0.1273	0.070	0.063	1.989	1.79
192	3.2	0.0422	0.1142	0.268	0.843	6.347	20.00
193	0.7	0.0327	0.2386	0.204	0.145	6.221	4.42
194	1.5	0.1949	0.2701	1.025	1.518	5.259	7.78
195	0.8	0.4719	0.4719	2.601	2.133	5.512	4.52
196	0.5	0.0569	0.5948	0.223	0.118	3.918	2.08
197	1.0	0.0595	0.0742	0.836	0.803	14.052	13.49
198	2.8	0.0098	0.0098	0.005	0.012	0.462	1.28
199	0.9	0.1875	0.3405	0.904	0.841	4.824	4.49
200	1.5	0.1875	0.3405	0.992	1.528	5.291	8.15
201	0.5	0.0075	0.0211	0.002	0.001	0.321	0.16
202	0.5	0.0054	0.2701	0.041	0.019	7.464	3.58
203	0.4	0.0014	0.0176	0.001	0.000	0.351	0.13
204	0.0	0.0017	0.0058	0.000	0.000	0.236	0.00
205	0.0	0.0021	0.0068	0.000	0.000	0.189	0.00
206	0.0	0.0027	0.0094	0.000	0.000	0.168	0.00
207	0.0	0.0032	0.0034	0.001	0.000	0.266	0.00
208	0.0	0.0226	0.0226	0.082	0.001	3.622	0.04
209	0.0	0.0058	0.0058	0.001	0.000	0.201	0.00
210	0.0	0.0027	0.0040	0.001	0.000	0.272	0.00
211	0.0	0.0019	0.0045	0.000	0.000	0.221	0.00
212	0.0	0.0290	0.0949	0.156	0.002	5.389	0.05
213	0.0	0.0645	0.0645	0.354	0.004	5.491	0.05
214	0.0	0.0357	0.0900	0.216	0.002	6.038	0.06
215	0.0	0.0485	0.0603	0.340	0.003	7.013	0.07
216	0.0	0.1549	0.1549	0.824	0.008	5.320	0.05
217	0.0	0.0041	0.0069	0.005	0.000	1.115	0.01
218	0.0	0.0074	0.0074	0.008	0.000	1.088	0.01
219	0.0	0.0046	0.0046	0.006	0.000	1.418	0.01
220	0.0	0.0044	0.0475	0.039	0.000	8.821	0.09
221	0.0	0.0372	0.0598	0.041	0.000	1.114	0.01
222	0.0	0.0713	0.0713	0.074	0.001	1.043	0.01
223	0.0	0.0031	0.0084	0.001	0.000	0.286	0.00
224	0.0	0.0042	0.0069	0.001	0.000	0.309	0.00
225	0.0	0.0041	0.0065	0.001	0.000	0.286	0.00
226	0.0	0.0038	0.0317	0.016	0.000	4.228	0.04
227	0.0	0.0035	0.0198	0.017	0.000	5.040	0.05
228	0.0	0.0040	0.0807	0.021	0.000	5.321	0.05
229	0.0	0.0039	0.1435	0.017	0.000	4.293	0.04
230	0.0	0.0038	0.0623	0.018	0.000	4.758	0.05
231	0.0	0.0038	0.0732	0.014	0.000	3.844	0.04
232	0.0	0.0037	0.1278	0.017	0.000	4.522	0.05
233	0.0	0.0026	0.0056	0.001	0.000	0.223	0.00
234	0.0	0.0020	0.0052	0.000	0.000	0.230	0.00
235	0.0	0.0015	0.0047	0.000	0.000	0.239	0.00
236	0.0	0.0024	0.0046	0.001	0.000	0.262	0.00
237	0.0	0.0017	0.0042	0.000	0.000	0.271	0.00
238	0.0	0.0015	0.0062	0.000	0.000	0.235	0.00
239	0.0	0.0078	0.0294	0.002	0.000	0.219	0.00
240	0.0	0.0092	0.0092	0.004	0.000	0.397	0.00
241	0.0	0.0087	0.0087	0.004	0.000	0.456	0.00
242	0.0	0.0241	0.0241	0.009	0.000	0.367	0.00
243	0.0	0.0095	0.0128	0.004	0.000	0.417	0.00
244	0.0	0.0092	0.1451	0.062	0.001	6.728	0.07
245	0.0	0.0089	0.1151	0.091	0.001	10.157	0.10
246	0.0	0.0052	0.0087	0.002	0.000	0.410	0.00
247	0.0	0.0043	0.0158	0.001	0.000	0.328	0.00
248	0.0	0.0037	0.0121	0.001	0.000	0.363	0.00
249	0.0	0.0033	0.0189	0.001	0.000	0.307	0.00
250	0.0	0.0030	0.0114	0.001	0.000	0.370	0.00
251	0.0	0.0036	0.0111	0.001	0.000	0.374	0.00
252	0.0	0.0045	0.0045	0.002	0.000	0.523	0.01
253	0.0	0.0078	0.0078	0.004	0.000	0.502	0.01
254	0.0	0.0045	0.0078	0.002	0.000	0.426	0.00
255	0.0	0.0036	0.0114	0.001	0.000	0.339	0.00
256	0.0	0.0044	0.0698	0.008	0.000	1.805	0.02
257	0.0	0.0065	0.0065	0.004	0.000	0.536	0.01
258	0.0	0.1694	0.1694	1.402	0.014	8.277	0.08
259	0.0	0.1146	0.2473	0.824	0.008	7.188	0.07
260	0.0	0.0472	0.0940	0.410	0.004	8.675	0.09
261	0.0	0.0737	0.0737	0.447	0.004	6.069	0.06
262	0.0	0.0318	0.0555	0.083	0.001	2.618	0.03
263	0.0	0.0555	0.0555	0.145	0.001	2.618	0.03
264	0.0	0.3154	0.3154	1.445	0.014	4.581	0.05

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 65   0.0   0.0086       0.0086       0.012    0.000     1.415       0.01
 66   0.0   0.0078       0.0447       0.027    0.000     3.444       0.03
267   0.0   0.0075       0.0723       0.033    0.000     4.422       0.04
268   0.0   0.0070       0.0606       0.031    0.000     4.408       0.04
269   0.0   0.0100       0.0100       0.003    0.000     0.268       0.00
 70   0.0   0.0143       0.0143       0.003    0.000     0.234       0.00
 71   0.0   0.0061       0.0086       0.002    0.000     0.283       0.00
 72   0.0   0.0059       0.0838       0.029    0.000     4.858       0.05
273   0.0   0.0201       0.0201       0.032    0.000     1.594       0.02
274   0.0   0.0147       0.0361       0.019    0.000     1.282       0.01
 75   0.0   1.0000       1.0000       0.000    0.000     0.000       0.00

PARAMETERS OF DELIVERY RATIO EQUATION
A =  14.000 AND B = 0.80461

 TAL SEDIMENT DELIVERED TO STREAM =    46.1 TONNES
 MES RUN FOR PITTOCK TEST, 1989
 OSPHORUS INPUT DATA FILE, IF CONDITIONS

WATERSHED AREA =  358.9 HECTARES

  MBER OF CELLS CONTRIBUTING TO PHOSPHORUS LOADING =    203

VARIABLE PARAMETERS
*******************

  GANIC MATTER (%) (1ST TO 9TH)
    3.7  3.5  0.0  0.0  3.8  3.7  0.0  0.0  3.8

NaHCO3 EXTRACTABLE P (ug/g) (1ST TO 9TH)
     21.0    26.7    24.0    23.1    23.1    20.1    22.7    18.5    18.5

  LL INPUT DATA SUMMARY
**********************

CELL   AREA   ORGANIC   NaHCO3   SURFACE
 O.           MATTER    EXTR P   P CONC.
       (ha)    (%)      (ug/g)   (ug/g)
 ***   ****  *******    ******   *******
   1    1.2      3.7      21.0     684.2
   2    0.5      3.7      21.0     684.2
   3    0.5      3.7      21.0     684.2
   4    0.4      3.7      21.0     684.2
   5    0.4      3.7      21.0     684.2
   6    0.8      3.7      21.0     684.2
   7    1.0      3.7      21.0     684.2
   8    0.5      3.7      21.0     684.2
   9    8.4      3.7      21.0     684.2
  10    0.4      3.7      21.0     684.2
  11    2.1      3.7      22.7     695.0
  12    1.5      3.7      18.5     666.8
  13    4.8      3.7      22.7     695.0
  14    1.2      3.7      22.7     695.0
  15    1.8      3.7      22.7     695.0
  16    0.7      3.7      21.0     684.2
  17    1.3      3.7      21.0     684.2
  18    0.9      3.7      21.0     684.2
  19    2.6      3.7      20.1     678.2
  20    4.0      3.7      26.7     717.0
  21    0.7      3.7      21.0     684.2
  22    1.0      3.7      26.7     717.0
  23    1.3      3.7      26.7     717.0
  24    8.0      3.7      23.1     697.4
  25    0.6      3.7      18.5     666.8
  26    2.1      3.7      26.7     717.0
  27    1.3      3.7      26.7     717.0
  28    0.5      3.7      23.1     697.4
  29    3.3      3.7      18.5     666.8
  30    0.4      3.7      26.7     717.0
  31    4.0      3.7      23.1     697.4
  32    1.1      3.7      26.7     717.0
  33    2.7      3.7      18.5     666.8
  34    6.8      3.7      23.1     697.4
  35    0.8      3.7      18.5     666.8
  36    0.5      3.7      18.5     666.8
  37    1.7      3.7      23.1     697.4
  38    0.4      3.7      23.1     697.4
  39    9.4      3.7      23.1     697.4
  40    9.0      3.7      23.1     697.4
  41    0.7      3.7      23.1     697.4
  42    0.5      3.7      23.1     697.4
  43    0.9      3.7      23.1     697.4
  44    0.5      3.7      23.1     697.4
  45    0.9      3.7      23.1     697.4
  46    1.5      3.7      23.1     697.4
  47    0.5      3.7      23.1     697.4
  48    0.9      3.7      18.5     666.8
  49    0.8      3.7      18.5     666.8
  50    0.6      3.7      23.1     697.4
  51    5.0      3.7      23.1     697.4
  52    1.9      3.7      23.1     697.4
  53    0.5      3.7      21.0     684.2
  54    0.5      3.7      18.5     666.8
  55    0.6      3.7      21.0     684.2
  56    0.4      3.7      21.0     684.2
  57    1.2      3.7      23.1     697.4
  58    4.3      3.7      18.5     666.8
  59    5.2      3.7      26.7     717.0
  60    5.5      3.7      18.5     666.8
  61    0.9      3.7      23.1     697.4
  62    1.4      3.7      22.7     695.0
  63    1.0      3.7      22.7     695.0
  64    1.8      3.7      21.0     684.2
  65    1.6      3.7      21.0     684.2
  66    4.1      3.7      21.0     684.2
  67    3.4      3.8      21.0     690.6
  68    0.7      3.7      23.1     697.4
  69    0.5      3.7      18.5     666.8
  70    0.7      3.7      21.0     684.2
  71    3.8      3.7      26.7     717.0
  72    3.4      3.7      21.0     684.2
  73    1.6      3.7      18.5     666.8
  74    2.1      3.7      21.0     684.2
  75    2.1      3.7      22.7     695.0
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76	1.2	3.7	22.7	695.0
77	0.4	3.7	21.0	684.2
78	0.7	3.7	21.0	684.2
79	0.5	3.7	18.5	666.8
80	1.4	3.7	18.5	666.8
81	3.7	3.7	22.7	695.0
82	0.6	3.7	23.1	697.4
83	1.9	3.7	21.0	684.2
84	1.4	3.7	21.0	684.2
85	4.0	3.7	22.7	695.0
86	1.2	3.7	21.0	684.2
87	1.3	3.7	21.0	684.2
88	5.7	3.7	23.1	697.4
89	1.6	3.7	21.0	684.2
90	0.4	3.7	21.0	684.2
91	1.9	3.7	23.1	697.4
92	0.4	3.7	18.5	666.8
93	4.0	3.7	21.0	684.2
94	0.5	3.7	21.0	684.2
95	2.6	3.7	21.0	684.2
96	0.9	3.7	21.0	684.2
97	0.5	3.7	22.7	695.0
98	4.3	3.7	23.1	697.4
99	1.2	3.7	20.1	678.2
100	1.4	3.7	21.0	684.2
101	1.1	3.8	21.0	690.6
102	2.9	3.7	26.7	717.0
103	0.9	3.7	26.7	717.0
104	1.8	3.7	21.0	684.2
105	1.4	3.7	18.5	666.8
106	0.6	3.7	22.7	695.0
107	0.6	3.7	26.7	717.0
108	0.6	3.7	22.7	695.0
109	1.3	3.7	21.0	684.2
110	0.4	3.7	21.0	684.2
111	0.5	3.7	22.7	695.0
112	1.8	3.7	22.7	695.0
113	1.5	3.7	26.7	717.0
114	2.1	3.7	23.1	697.4
115	0.7	3.7	26.7	717.0
116	3.4	3.7	21.0	684.2
117	1.7	3.7	24.0	702.7
118	1.4	3.7	23.1	697.4
119	2.5	3.7	26.7	717.0
120	1.0	3.7	21.0	684.2
121	0.4	3.7	26.7	717.0
122	1.2	3.7	21.0	684.2
123	0.9	3.7	24.0	702.7
124	3.6	3.7	22.7	695.0
125	1.9	3.8	18.5	673.1
126	1.8	3.7	23.1	697.4
127	0.9	3.7	26.7	717.0
128	3.1	3.7	24.0	702.7
129	0.5	3.7	26.7	717.0
130	0.4	3.7	24.0	702.7
131	5.9	3.7	24.0	702.7
132	0.6	3.7	21.0	684.2
133	0.8	3.7	18.5	666.8
134	0.6	3.7	21.0	684.2
135	0.8	3.7	23.1	697.4
136	0.5	3.7	24.0	702.7
137	0.7	3.8	24.0	709.0
138	3.7	3.7	23.1	697.4
139	0.9	3.7	26.7	717.0
140	4.7	3.7	26.7	717.0
141	3.4	3.7	21.0	684.2
142	2.7	3.7	22.7	695.0
143	0.8	3.7	21.0	684.2
144	0.7	3.7	23.1	697.4
145	0.6	3.7	18.5	666.8
146	1.2	3.7	18.5	666.8
147	2.1	3.7	18.5	666.8
148	1.5	3.7	21.0	684.2
149	0.8	3.7	21.0	684.2
150	1.3	3.7	18.5	666.8
151	3.6	3.7	21.0	684.2
152	1.7	3.7	21.0	684.2
153	3.1	3.7	26.7	717.0
154	2.9	3.7	22.7	695.0
155	6.0	3.7	21.0	684.2
156	1.9	3.7	21.0	684.2
157	1.3	3.7	21.0	684.2
158	0.9	3.7	21.0	684.2
159	2.9	3.7	24.0	702.7
160	2.2	3.7	21.0	684.2
161	2.5	3.8	21.0	690.6
162	2.2	3.7	21.0	684.2
163	1.0	3.7	21.0	684.2
164	4.0	3.7	23.1	697.4
165	1.4	3.7	24.0	702.7
166	0.4	3.7	18.5	666.8
167	2.7	3.7	21.0	684.2
168	0.5	3.7	26.7	717.0
169	1.7	3.7	21.0	684.2
170	1.1	3.7	22.7	695.0
171	3.2	3.7	22.7	695.0
172	0.5	3.7	23.1	697.4
173	5.5	3.7	21.0	684.2
174	0.7	3.7	23.1	697.4
175	1.8	3.7	18.5	666.8

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 76     1.2      3.7      18.5     666.8
 77     0.5      3.7      18.5     666.8
 78     1.2      3.7      18.5     666.8
179     0.5      3.7      18.5     666.8
180     0.9      3.7      21.0     684.2
 81     0.5      3.7      22.7     695.0
 82     1.1      3.5      21.0     666.4
 83     0.7      3.5      21.0     666.4
184     0.9      3.7      24.0     702.7
185     1.2      3.7      24.0     702.7
186     1.6      3.7      18.5     666.8
 87     0.4      3.7      26.7     717.0
 88     1.0      3.5      26.7     699.1
 89     1.3      3.7      26.7     717.0
190     1.3      3.5      26.7     699.1
191     0.9      3.7      26.7     717.0
 92     3.2      3.7      26.7     717.0
 93     0.7      3.7      26.7     717.0
 94     1.5      3.7      21.0     684.2
195     0.8      3.7      21.0     684.2
196     0.5      3.7      21.0     684.2
197     1.0      3.8      21.0     690.6
 98     2.8      3.7      22.7     695.0
 99     0.9      3.7      21.0     684.2
200     1.5      3.7      21.0     684.2
201     0.5      3.7      22.7     695.0
202     0.5      3.7      23.1     697.4
203     0.4      3.7      18.5     666.8

PARAMETERS OF PER EQUATION
a = 7.500 AND b = 0.200

UMMARY OF CELL PHOSPHORUS LOADING VALUES
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CELL  AREA  SURFACE  CELL     SED DEL  P LOAD  CELL    SED DEL  P LOAD  P LOAD
NO.         P CONC.  PER TO   TO ADJ   TO ADJ  PER TO  TO STM   TO STM  RATE
                     ADJ CELL CELL     CELL    STM                      TO STM
 **   ****  *******  *******  *******  ******  ******  *******  ******  ******
   1   1.2   684.2       1.2    10.54     8.7     3.7     0.04     0.1     0.1
   2   0.5   684.2       1.6     1.26     1.4     4.5     0.01     0.0     0.0
   3   0.5   684.2       2.2     0.27     0.4     5.2     0.00     0.0     0.0
   4   0.4   684.2       1.8     0.60     0.7     5.6     0.00     0.0     0.0
   5   0.4   684.2       3.2     0.03     0.1     5.3     0.00     0.0     0.0
   6   0.8   684.2       2.6     0.18     0.3     4.3     0.01     0.0     0.0
   7   1.0   684.2       2.3     0.41     0.6     5.2     0.01     0.0     0.0
   8   0.5   684.2       1.7     0.93     1.1     4.1     0.01     0.0     0.1
   9   8.4   684.2       1.8    10.78    13.2     4.2     0.16     0.4     0.1
  10   0.4   684.2       2.4     0.12     0.2     4.3     0.01     0.0     0.0
  11   2.1   695.0       5.2     0.01     0.0     8.3     0.00     0.0     0.0
  12   1.5   666.8       5.1     0.01     0.0     7.7     0.00     0.0     0.0
  13   4.8   695.0       5.7     0.02     0.1     7.4     0.01     0.0     0.0
  14   1.2   695.0       5.3     0.01     0.0     8.1     0.00     0.0     0.0
  15   1.8   695.0       5.1     0.01     0.0     5.6     0.01     0.0     0.0
  16   0.7   684.2       1.5     2.26     2.3     4.6     0.01     0.0     0.0
  17   1.3   684.2       1.6     2.74     3.0     3.7     0.04     0.1     0.1
  18   0.9   684.2       1.5     2.44     2.6     4.5     0.01     0.0     0.0
  19   2.6   678.2       3.7     0.09     0.2     4.1     0.05     0.1     0.1
  20   4.0   717.0       2.1     2.41     3.6     3.7     0.14     0.4     0.1
  21   0.7   684.2       1.6     1.81     1.9     3.7     0.03     0.1     0.1
  22   1.0   717.0       2.1     0.64     1.0     3.9     0.03     0.1     0.1
  23   1.3   717.0       2.0     1.02     1.4     2.8     0.19     0.4     0.3
  24   8.0   697.4       1.7    13.46    15.9     1.8    10.92    13.5     1.7
  25   0.6   666.8       4.9     0.00     0.0     4.9     0.00     0.0     0.0
  26   2.1   717.0       2.1     1.29     1.9     4.4     0.03     0.1     0.0
  27   1.3   717.0       2.0     0.87     1.3     3.8     0.04     0.1     0.1
  28   0.5   697.4       1.5     1.63     1.7     2.0     0.38     0.5     1.0
  29   3.3   666.8       4.0     0.07     0.2     4.1     0.07     0.2     0.1
  30   0.4   717.0       1.9     0.37     0.5     3.7     0.01     0.0     0.1
  31   4.0   697.4       1.6     9.65    10.6     1.9     3.69     4.9     1.2
  32   1.1   717.0       1.9     0.97     1.3     4.5     0.01     0.0     0.0
  33   2.7   666.8       3.9     0.07     0.2     3.9     0.07     0.2     0.1
  34   6.8   697.4       1.6    17.23    18.8     1.7    10.00    12.2     1.8
  35   0.8   666.8       3.9     0.02     0.1     4.2     0.01     0.0     0.1
  36   0.5   666.8       3.7     0.02     0.0     4.3     0.01     0.0     0.0
  37   1.7   697.4       1.5     6.08     6.2     1.8     2.10     2.6     1.5
  38   0.4   697.4       2.2     0.18     0.3     2.8     0.06     0.1     0.3
  39   9.4   697.4       1.6    21.78    24.2     2.4     2.54     4.3     0.5
  40   9.0   697.4       1.6    19.12    21.6     1.7    16.97    19.6     2.2
  41   0.7   697.4       1.1     9.12     7.1     2.3     0.25     0.4     0.6
  42   0.5   697.4       1.4     2.21     2.2     2.6     0.10     0.2     0.3
  43   0.9   697.4       1.2     7.75     6.7     3.0     0.09     0.2     0.2
  44   0.5   697.4       1.5     1.78     1.8     4.3     0.01     0.0     0.1
  45   0.9   697.4       1.5     2.66     2.8     4.5     0.01     0.0     0.0
  46   1.5   697.4       1.5     4.41     4.7     1.8     1.85     2.3     1.6
  47   0.5   697.4       2.1     0.28     0.4     4.6     0.01     0.0     0.0
  48   0.9   666.8       4.8     0.01     0.0     8.7     0.00     0.0     0.0
  49   0.8   666.8       4.9     0.01     0.0     6.9     0.00     0.0     0.0
  50   0.6   697.4       1.4     2.83     2.7     2.7     0.09     0.2     0.3
  51   5.0   697.4       1.7     8.37     9.9     3.3     0.31     0.7     0.1
  52   1.9   697.4       1.5     5.15     5.5     3.9     0.05     0.1     0.1
  53   0.5   684.2       2.3     0.20     0.3     4.4     0.01     0.0     0.0
  54   0.5   666.8       4.6     0.01     0.0     7.7     0.00     0.0     0.0
  55   0.6   684.2       1.5     1.98     2.0     4.6     0.01     0.0     0.0
  56   0.4   684.2       1.5     1.33     1.4     4.7     0.00     0.0     0.0
  57   1.2   697.4       1.5     3.25     3.5     4.2     0.02     0.1     0.1
  58   4.3   666.8       4.0     0.09     0.3     5.2     0.03     0.1     0.0
  59   5.2   717.0       2.4     1.63     2.8     3.4     0.27     0.7     0.1
```

60	5.5	666.8	3.9	0.14	0.4	4.1	0.11	0.3	0.1
61	0.9	697.4	1.5	2.79	2.9	2.6	0.18	0.3	0.4
62	1.4	695.0	4.3	0.02	0.1	6.4	0.00	0.0	0.0
63	1.0	695.0	4.0	0.02	0.1	6.8	0.00	0.0	0.0
64	1.8	684.2	1.6	3.91	4.3	4.0	0.04	0.1	0.1
65	1.6	684.2	1.7	3.06	3.5	3.5	0.07	0.2	0.1
66	4.1	684.2	1.8	5.40	6.6	2.5	0.98	1.7	0.4
67	3.4	690.6	1.9	3.66	4.7	0.0	0.00	0.0	0.0
68	0.7	697.4	1.3	3.89	3.6	2.7	0.12	0.2	0.3
69	0.5	666.8	3.6	0.02	0.1	4.9	0.00	0.0	0.0
70	0.7	684.2	1.5	2.01	2.1	2.6	0.13	0.2	0.3
71	3.8	717.0	2.0	2.59	3.8	0.0	0.00	0.0	0.0
72	3.4	684.2	1.7	5.38	6.3	3.3	0.19	0.4	0.1
73	1.6	666.8	5.4	0.01	0.0	5.7	0.01	0.0	0.0
74	2.1	684.2	1.6	4.23	4.7	3.4	0.10	0.2	0.1
75	2.1	695.0	4.3	0.04	0.1	4.8	0.02	0.1	0.0
76	1.2	695.0	4.3	0.02	0.1	5.6	0.01	0.0	0.0
77	0.4	684.2	1.6	1.05	1.1	3.6	0.02	0.0	0.1
78	0.7	684.2	1.6	1.56	1.7	2.6	0.14	0.2	0.4
79	0.5	666.8	4.7	0.01	0.0	5.0	0.00	0.0	0.0
80	1.4	666.8	4.0	0.03	0.1	4.0	0.03	0.1	0.1
81	3.7	695.0	5.4	0.02	0.1	6.7	0.01	0.0	0.0
82	0.6	697.4	1.5	1.81	1.9	2.6	0.13	0.2	0.4
83	1.9	684.2	1.6	4.11	4.5	2.6	0.37	0.7	0.4
84	1.4	684.2	1.5	5.12	5.1	3.4	0.07	0.2	0.1
85	4.0	695.0	5.5	0.02	0.1	6.7	0.01	0.0	0.0
86	1.2	684.2	1.6	2.88	3.1	3.4	0.06	0.1	0.1
87	1.3	684.2	1.7	2.13	2.5	2.7	0.22	0.4	0.3
88	5.7	697.4	1.6	13.98	15.4	3.1	0.50	1.1	0.2
89	1.6	684.2	1.6	3.88	4.2	3.3	0.10	0.2	0.1
90	0.4	684.2	1.4	1.81	1.8	3.5	0.02	0.0	0.1
91	1.9	697.4	1.6	4.46	5.0	3.2	0.13	0.3	0.2
92	0.4	666.8	4.4	0.01	0.0	4.4	0.01	0.0	0.0
93	4.0	684.2	1.7	7.57	8.6	3.3	0.25	0.6	0.1
94	0.5	684.2	2.2	0.21	0.3	3.6	0.02	0.0	0.1
95	2.6	684.2	1.7	4.67	5.4	3.5	0.13	0.3	0.1
96	0.9	684.2	1.4	3.37	3.3	3.6	0.04	0.1	0.1
97	0.5	695.0	3.8	0.01	0.0	4.7	0.00	0.0	0.0
98	4.3	697.4	1.6	11.07	12.1	3.2	0.32	0.7	0.2
99	1.2	678.2	3.2	0.08	0.2	6.1	0.00	0.0	0.0
100	1.4	684.2	1.6	3.58	3.8	3.3	0.08	0.2	0.1
101	1.1	690.6	2.3	0.38	0.6	3.5	0.05	0.1	0.1
102	2.9	717.0	2.8	0.39	0.8	4.8	0.03	0.1	0.0
103	0.9	717.0	2.0	0.61	0.9	3.8	0.03	0.1	0.1
104	1.8	684.2	1.5	5.58	5.7	3.3	0.11	0.2	0.1
105	1.4	666.8	4.0	0.03	0.1	4.7	0.01	0.0	0.0
106	0.6	695.0	5.1	0.00	0.0	6.8	0.00	0.0	0.0
107	0.6	717.0	2.5	0.12	0.2	5.2	0.00	0.0	0.0
108	0.6	695.0	4.6	0.01	0.0	6.6	0.00	0.0	0.0
109	1.3	684.2	1.4	4.73	4.7	3.7	0.04	0.1	0.1
110	0.4	684.2	1.6	0.86	1.0	3.5	0.02	0.0	0.1
111	0.5	695.0	4.6	0.01	0.0	6.7	0.00	0.0	0.0
112	1.8	695.0	5.4	0.01	0.0	6.4	0.00	0.0	0.0
113	1.5	717.0	2.4	0.47	0.8	4.2	0.03	0.1	0.1
114	2.1	697.4	1.5	5.70	6.1	3.3	0.12	0.3	0.1
115	0.7	717.0	2.3	0.29	0.5	4.2	0.01	0.0	0.1
116	3.4	684.2	1.6	7.99	8.7	3.2	0.24	0.5	0.2
117	1.7	702.7	2.0	1.23	1.7	4.2	0.03	0.1	0.1
118	1.4	697.4	1.5	4.80	4.9	3.2	0.09	0.2	0.1
119	2.5	717.0	2.4	0.79	1.3	4.1	0.05	0.2	0.1
120	1.0	684.2	1.5	2.96	3.0	3.6	0.04	0.1	0.1
121	0.4	717.0	1.9	0.45	0.6	4.1	0.01	0.0	0.1
122	1.2	684.2	1.6	3.14	3.3	3.3	0.07	0.2	0.1
123	0.9	702.7	2.7	0.15	0.3	4.2	0.02	0.0	0.1
124	3.6	695.0	5.5	0.02	0.1	6.1	0.01	0.0	0.0
125	1.9	673.1	4.8	0.02	0.1	5.0	0.01	0.0	0.0
126	1.8	697.4	1.5	5.61	5.9	3.3	0.11	0.3	0.1
127	0.9	717.0	2.1	0.52	0.8	2.5	0.20	0.4	0.4
128	3.1	702.7	2.1	1.79	2.7	3.6	0.12	0.3	0.1
129	0.5	717.0	1.9	0.41	0.6	2.8	0.06	0.1	0.3
130	0.4	702.7	1.8	0.58	0.7	3.1	0.04	0.1	0.2
131	5.9	702.7	2.2	2.75	4.2	3.6	0.23	0.6	0.1
132	0.6	684.2	1.6	1.51	1.6	3.5	0.03	0.1	0.1
133	0.8	666.8	4.8	0.01	0.0	5.4	0.00	0.0	0.0
134	0.6	684.2	1.6	1.26	1.4	3.4	0.03	0.1	0.1
135	0.8	697.4	2.2	0.35	0.6	3.3	0.05	0.1	0.1
136	0.5	702.7	2.0	0.38	0.5	3.7	0.02	0.0	0.1
137	0.7	709.0	2.6	0.14	0.3	3.8	0.02	0.1	0.1
138	3.7	697.4	1.6	9.54	10.4	3.7	0.14	0.3	0.1
139	0.9	717.0	2.2	0.45	0.7	4.1	0.02	0.1	0.1
140	4.7	717.0	2.2	2.15	3.4	3.5	0.22	0.5	0.1
141	3.4	684.2	1.7	6.46	7.3	2.0	2.83	3.8	1.1
142	2.7	695.0	5.9	0.01	0.0	6.7	0.00	0.0	0.0
143	0.8	684.2	1.5	2.53	2.6	3.6	0.03	0.1	0.1
144	0.7	697.4	1.5	2.10	2.2	3.8	0.02	0.1	0.1
145	0.6	666.8	4.9	0.01	0.0	7.8	0.00	0.0	0.0
146	1.2	666.8	5.2	0.01	0.0	6.2	0.00	0.0	0.0
147	2.1	666.8	5.1	0.01	0.0	5.3	0.01	0.0	0.0
148	1.5	684.2	1.6	3.30	3.6	4.1	0.03	0.1	0.1
149	0.8	684.2	1.7	1.33	1.6	4.0	0.02	0.1	0.1
150	1.3	666.8	5.1	0.01	0.0	7.4	0.00	0.0	0.0
151	3.6	684.2	1.7	5.47	6.5	3.5	0.17	0.4	0.1
152	1.7	684.2	1.8	2.11	2.6	1.8	2.11	2.6	1.5
153	3.1	717.0	2.5	0.70	1.3	3.6	0.12	0.3	0.1
154	2.9	695.0	3.2	0.19	0.4	3.3	0.19	0.4	0.1
155	6.0	684.2	1.6	11.96	13.4	2.2	2.58	3.9	0.7
156	1.9	684.2	2.5	0.43	0.7	4.8	0.02	0.1	0.0
157	1.3	684.2	1.7	2.28	2.6	3.7	0.04	0.1	0.1
158	0.9	684.2	2.5	0.23	0.4	3.8	0.03	0.1	0.1
159	2.9	702.7	2.1	1.51	2.3	4.2	0.05	0.2	0.1

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160   2.2   684.2      2.5      0.49    0.9    3.7    0.08    0.2    0.1
161   2.5   690.6      2.3      0.83    1.3    2.4    0.81    1.3    0.5
162   2.2   684.2      1.5      5.79    6.1    2.3    0.74    1.2    0.5
163   1.0   684.2      1.7      2.01    2.3    1.7    2.01    2.3    2.2
164   4.0   697.4      1.9      4.04    5.3    2.4    1.17    2.0    0.5
165   1.4   702.7      2.7      0.21    0.4    3.7    0.04    0.1    0.1
166   0.4   666.8      4.8      0.00    0.0    7.8    0.00    0.0    0.0
167   2.7   684.2      1.8      3.00    3.8    1.9    2.38    3.2    1.2
168   0.5   717.0      2.4      0.14    0.2    3.9    0.01    0.0    0.1
169   1.7   684.2      3.8      0.05    0.1    5.4    0.01    0.0    0.0
170   1.1   695.0      3.1      0.09    0.2    3.1    0.09    0.2    0.2
171   3.2   695.0      3.5      0.14    0.3    3.5    0.14    0.3    0.1
172   0.5   697.4      1.6      0.94    1.1    2.8    0.06    0.1    0.3
173   5.5   684.2      2.8      0.82    1.5    5.2    0.03    0.1    0.0
174   0.7   697.4      2.6      0.14    0.3    2.8    0.09    0.2    0.3
175   1.8   666.8      4.0      0.04    0.1    4.7    0.02    0.1    0.0
176   1.2   666.8      3.8      0.03    0.1    3.8    0.03    0.1    0.1
177   0.5   666.8      3.6      0.02    0.0    3.6    0.02    0.0    0.1
178   1.2   666.8      3.8      0.04    0.1    4.1    0.03    0.1    0.1
179   0.5   666.8      3.5      0.02    0.1    3.5    0.02    0.1    0.1
180   0.9   684.2      1.2      7.65    6.4    2.0    0.64    0.9    1.0
181   0.5   695.0      3.0      0.05    0.1    3.0    0.05    0.1    0.2
182   1.1   666.4      1.6      2.77    2.9    2.2    0.47    0.7    0.7
183   0.7   666.4      1.5      2.31    2.3    2.3    0.25    0.4    0.6
184   0.9   702.7      1.9      0.85    1.2    1.9    0.85    1.2    1.2
185   1.2   702.7      1.6      3.20    3.5    1.8    1.72    2.1    1.8
186   1.6   666.8      2.9      0.17    0.3    3.0    0.15    0.3    0.2
187   0.4   717.0      2.4      0.12    0.2    4.1    0.01    0.0    0.1
188   1.0   699.1      2.5      0.23    0.4    3.9    0.03    0.1    0.1
189   1.3   717.0      1.9      1.30    1.7    2.5    0.28    0.5    0.4
190   1.3   699.1      2.4      0.35    0.6    3.1    0.10    0.2    0.2
191   0.9   717.0      2.5      0.23    0.4    3.2    0.06    0.1    0.2
192   3.2   717.0      2.0      2.28    3.3    2.5    0.84    1.5    0.5
193   0.7   717.0      1.7      1.05    1.3    2.6    0.14    0.3    0.4
194   1.5   684.2      1.7      2.54    2.9    1.8    1.83    2.3    1.5
195   0.8   684.2      1.5      2.57    2.6    1.5    2.57    2.6    3.2
196   0.5   684.2      1.5      1.49    1.6    2.4    0.14    0.2    0.5
197   1.0   690.6      1.8      1.21    1.5    1.9    0.97    1.3    1.3
198   2.8   695.0      5.5      0.01    0.0    5.5    0.01    0.0    0.0
199   0.9   684.2      1.6      1.84    2.1    1.9    1.01    1.3    1.4
200   1.5   684.2      1.6      3.35    3.7    1.8    1.84    2.3    1.5
201   0.5   695.0      5.1      0.00    0.0    6.3    0.00    0.0    0.0
202   0.5   697.4      1.6      1.14    1.3    3.5    0.02    0.1    0.1
203   0.4   666.8      5.2      0.00    0.0    8.4    0.00    0.0    0.0

AVERAGE PHOSPHORUS ENRICHMENT RATIO=  2.2

MINIMUM PHOSPHORUS ENRICHMENT RATIO=  1.5
MAXIMUM PHOSPHORUS ENRICHMENT RATIO=  8.7

TOTAL PHOSPHORUS LOAD DELIVERED TO STREAM =   123.0 kg
AVERAGE PHOSPHORUS LOAD DELIVERED TO STREAM =      0.3 kg/ha
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1
                                  DAILY PRECIPITATION (mm)

                                Summary for MONTH  1989/ 1/

                                Data interval:    60 mins

  DAY        SUM                Interval Number
                           1        2        3        4        5        6        7        8        9       10       11       12
                          13       14       15       16       17       18       19       20       21       22       23       24

    4       0.76        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.51
                        0.25     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
    7       1.79        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     1.79     0.00
    8       4.89        0.00     0.00     2.60     2.04     0.00     0.00     0.00     0.00     0.00     0.25     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   12       2.34        0.00     0.00     0.00     0.00     0.00     0.51     0.79     1.04     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   14       3.93        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     1.04     1.07     0.79     1.04     0.00
   20       0.51        0.00     0.00     0.00     0.00     0.25     0.25     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00

   26       8.47        0.51     0.81     2.32     3.76     0.81     0.00     0.25     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   29       1.57        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.25     0.00     0.53     0.51     0.28     0.00     0.00     0.00     0.00     0.00
   30       0.23        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.23     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00

MONTH  SUM : 2.44950E+01
1
                                  DAILY PRECIPITATION (mm)

                                Summary for MONTH  1989/ 2/

                                Data interval:    60 mins

  DAY        SUM                Interval Number
                           1        2        3        4        5        6        7        8        9       10       11       12
                          13       14       15       16       17       18       19       20       21       22       23       24

   13       0.79        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.79     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   14       1.07        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.56     0.00     0.25
                        0.00     0.25     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   21       5.49        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     1.83     2.62
                        1.04     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   22       0.25        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.25
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   26       2.34        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.48     0.53
                        1.04     0.00     0.28     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   27       3.38        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.51
                        0.79     1.32     0.00     0.76     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
MONTH  SUM : 1.33070E+01

                                  DAILY PRECIPITATION (mm)

                                Summary for MONTH  1989/ 3/

                                Data interval:    60 mins

  DAY        SUM                Interval Number
                           1        2        3        4        5        6        7        8        9       10       11       12
                          13       14       15       16       17       18       19       20       21       22       23       24

    4       1.82        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.28     0.51
                        0.28     0.25     0.00     0.00     0.50     0.00     0.00     0.00     0.00     0.00     0.00     0.00
   27       0.30        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.30     0.00     0.00
   28       3.60        0.00     0.30     0.00     0.00     0.30     0.00     0.00     0.00     0.20     0.00     0.00     0.00
                        0.00     0.00     0.50     0.50     0.00     0.00     0.00     0.20     0.00     0.50     0.80     0.30
 ONTH  SUM : 5.71600E+00

                                  DAILY PRECIPITATION (mm)

                                Summary for MONTH  1989/ 4/

                                Data interval:    60 mins

  DAY        SUM                Interval Number
                           1        2        3        4        5        6        7        8        9       10       11       12
                          13       14       15       16       17       18       19       20       21       22       23       24

    2       2.10        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.20     0.60     0.40     0.90
    3       8.80        0.40     0.30     1.00     1.20     0.70     1.00     1.40     1.50     0.80     0.40     0.10     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
    4       5.90        0.70     0.70     0.90     0.90     1.60     1.00     0.00     0.00     0.10     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
    5       3.40        0.10     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.00     0.00     1.40     1.60     0.20     0.00     0.00     0.00     0.10     0.00

   12       2.80        0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
                        0.00     0.00     0.10     0.90     1.60     0.20     0.00     0.00     0.00     0.00     0.00     0.00
  13        3.70        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.40   1.20
                        1.90   0.20   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
  14        6.50        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   1.20   1.60   3.70
  15        1.30        1.20   0.00   0.00   0.10   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00

  17        5.70        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.50   1.60   0.90
                        0.00   1.50   0.80   0.00   0.00   0.10   0.20   0.10   0.00   0.00   0.00   0.00
  26        4.70        0.00   0.00   0.30   1.20   3.00   0.20   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
  29        4.40        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   3.50   0.50   0.40   0.00   0.00   0.00   0.00   0.00   0.00
MONTH  SUM : 4.93000E+01

                              DAILY PRECIPITATION (mm)

                           Summary for MONTH  1989/ 5/

                           Data interval:    60 mins

 DAY       SUM             Interval Number
                           1      2      3      4      5      6      7      8      9     10     11     12
                          13     14     15     16     17     18     19     20     21     22     23     24


   2        0.40        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.10   0.30   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   5        8.50        0.00   0.70   0.80   1.00   1.80   1.10   0.40   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   2.40   0.20   0.10   0.00   0.00

  10        0.10        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.10   0.00

  11        3.10        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.50   0.10   0.70   0.40   0.10   0.40   0.50   0.40   0.00
  12        8.00        0.00   0.10   0.10   0.50   0.00   0.10   0.00   0.00   0.00   0.10   0.40   1.10
                        0.00   0.00   0.30   3.40   1.50   0.30   0.10   0.00   0.00   0.00   0.00   0.00
  20        5.10        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   1.50   1.20
                        0.30   0.10   0.00   0.00   0.00   0.00   1.60   0.10   0.30   0.00   0.00   0.00

  23        5.40        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.30   2.40   1.90   0.70   0.10   0.00   0.00   0.00   0.00   0.00
  25        5.60        0.00   0.00   0.00   0.00   0.00   0.00   0.60   2.50   0.20   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   2.30

  26       15.50       12.00   1.10   1.20   1.10   0.00   0.00   0.00   0.00   0.10   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
  30       24.20        0.00   3.20   9.90   4.20   0.60   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.20   0.60   3.60   0.20   1.60   0.10   0.00

  31        4.80        0.00   0.00   0.00   0.00   0.00   0.30   0.70   1.60   0.40   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.30   0.90   0.00   0.30   0.30   0.00
 MONTH  SUM : 8.07000E+01
1
                              DAILY PRECIPITATION (mm)

                           Summary for MONTH  1989/ 6/

                           Data interval:    60 mins

 DAY       SUM             Interval Number
                           1      2      3      4      5      6      7      8      9     10     11     12
                          13     14     15     16     17     18     19     20     21     22     23     24


   1        1.10        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   1.10   0.00   0.00   0.00   0.00   0.00
   2        8.10        0.00   0.20   4.50   2.60   0.70   0.10   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   3        2.60        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   1.00   0.40   0.30   0.60   0.00   0.00   0.10   0.20
   4        0.10        0.10   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   8        2.30        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   1.90   0.40   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   9       20.90        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.60   0.30   0.00   0.00   0.00   0.00   0.00  13.70   6.30   0.00   0.00
  12        0.60        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.10   0.30   0.10   0.10   0.00   0.00   0.00   0.00
  16        1.50        0.30   0.10   0.30   0.20   0.00   0.30   0.00   0.10   0.00   0.00   0.00   0.00
                        0.00   0.00   0.20   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
  17       12.70        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.20   0.00   0.00
                        0.00   2.00   2.30   0.10   4.00   0.20   0.00   0.00   0.00   0.00   3.90   0.00
  19        5.10        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.90   2.30   1.60   0.10   0.00   0.20
  20        1.00        0.00   0.10   0.60   0.10   0.10   0.00   0.00   0.00   0.10   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00

  21        2.90        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.60   0.80   0.20   0.00   0.00   0.00   0.00   0.30   1.00
  22       16.90       10.10   5.40   0.00   0.00   0.40   1.00   0.00   0.00   0.00   0.00   0.00   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
  26        0.80        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.80   0.00
                        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
 MONTH  SUM : 7.66000E+01
1
                              DAILY PRECIPITATION (mm)

                           Summary for MONTH  1989/ 7/
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                              Data interval:    60 mins

DAY        SUM                Interval Number
                           1       2       3       4       5       6       7       8       9      10      11      12
                          13      14      15      16      17      18      19      20      21      22      23      24

  12      1.30          0.00    0.00    0.00    0.00    0.00    0.00    0.20    0.50    0.50    0.10    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  13      0.10          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  19     27.20          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    8.80   12.90    0.90    3.30    1.20    0.10    0.00
  20      4.40          0.00    0.00    0.00    0.10    0.10    0.00    1.40    0.40    0.20    1.00    0.60    0.60
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

  25      1.80          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    1.10    0.60    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00

  27     14.30          0.00    0.00    0.00    0.00    0.00    0.10    0.60    0.00    0.00    0.00    0.00    0.00
                        0.00    5.50    8.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  30      0.20          0.10    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
MONTH  SUM : 4.93000E+01

                                  DAILY PRECIPITATION (mm)

                              Summary for MONTH  1989/ 8/

                              Data interval:    60 mins

DAY        SUM                Interval Number
                           1       2       3       4       5       6       7       8       9      10      11      12
                          13      14      15      16      17      18      19      20      21      22      23      24

   4      7.90          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.20    0.00    0.10    0.00
                        1.10    2.80    2.50    1.20    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   7      0.10          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   9      0.80          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.70    0.10    0.00    0.00
  10      0.10          0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

  15     25.80          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.60    0.00    0.00
                        0.00    0.30    0.00    0.10   14.20    8.50    2.00    0.00    0.00    0.10    0.00    0.00

  16      0.10          0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  20      0.10          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00

  21      0.10          0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  22      1.30          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.40
                        0.80    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  28      0.90          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.60    0.30    0.00    0.00    0.00
  29      2.30          0.50    0.90    0.50    0.30    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  31      0.80          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.80
 NTH  SUM : 4.03000E+01

                                  DAILY PRECIPITATION (mm)

                              Summary for MONTH  1989/ 9/

                              Data interval:    60 mins

DAY        SUM                Interval Number
                           1       2       3       4       5       6       7       8       9      10      11      12
                          13      14      15      16      17      18      19      20      21      22      23      24

   1      5.70          1.40    0.00    1.40    0.00    0.60    0.00    0.10    0.20    0.00    0.00    0.60    0.20
                        0.90    0.10    0.20    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   6      1.90          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    1.80    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   7      4.40          0.00    0.00    0.00    0.10    3.30    0.70    0.10    0.20    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   8      0.10          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10
   9      0.20          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.20    0.00    0.00    0.00
  13      0.30          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.20
                        0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  14      3.30          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.20    0.60    1.10    1.20    0.20    0.00    0.00    0.00    0.00    0.00
  15      0.10          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

  16      6.80          0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10
                        0.60    2.40    0.10    0.00    0.40    0.00    0.00    0.10    0.40    0.20    0.20    2.30
  17      0.60          0.50    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                        0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  22      2.60          0.00    0.00    0.00    0.10    0.30    0.00    0.00    0.00    0.00    0.00    0.00    0.00
```

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                              0.00    0.00    0.00    0.00    0.00    0.10    0.30    1.20    0.60    0.00    0.00    0.00
   23        1.30             0.40    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.30    0.00
                              0.30    0.20    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 MONTH  SUM : 2.73000E+01
1
                                        DAILY PRECIPITATION (mm)

                                      Summary for MONTH  1989/10/

                                      Data interval:    60 mins

   DAY        SUM                     Interval Number
                                1       2       3       4       5       6       7       8       9      10      11      12
                               13      14      15      16      17      18      19      20      21      22      23      24


    2        1.70             0.00    0.00    0.00    0.80    0.40    0.20    0.10    0.20    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    3        0.40             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.10    0.20    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    5        2.20             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    1.70    0.40    0.00    0.10    0.00

    6        1.40             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.60    0.30    0.30    0.20
    7        2.10             0.10    0.00    0.20    0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.20
                              0.10    0.00    0.00    0.00    0.00    0.10    0.00    0.20    0.70    0.20    0.00    0.20
    8        0.10             0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   10       31.80             0.00    0.00    0.00    0.00    0.00    0.10    1.20    2.10    5.70    4.10    1.90    1.10
                              0.80    1.00    1.20    1.60    4.80    6.00    0.10    0.10    0.00    0.00    0.00    0.00

   11        0.20             0.20    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   16        1.20             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    1.20    0.00    0.00    0.00    0.00    0.00    0.00
   17        5.50             0.00    0.00    0.10    0.00    0.00    0.00    0.20    0.50    0.80    0.40    0.70    0.80
                              0.50    0.30    0.50    0.20    0.00    0.10    0.10    0.00    0.00    0.00    0.10    0.20
   18        0.50             0.10    0.10    0.10    0.00    0.00    0.00    0.10    0.00    0.10    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   19        2.10             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.10    0.30    0.30    0.10    0.10    0.30    0.00    0.30    0.30    0.20    0.10
   20        4.40             0.30    0.40    1.00    0.90    0.90    0.20    0.10    0.00    0.00    0.00    0.00    0.00
                              0.00    0.10    0.00    0.00    0.00    0.00    0.20    0.20    0.10    0.00    0.00    0.00

   21        4.90             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10    2.30    1.30
                              0.00    0.30    0.50    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.30    0.00
   25        0.10             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

   31        0.70             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00
                              0.40    0.00    0.00    0.10    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 MONTH  SUM : 5.93000E+01
1
                                        DAILY PRECIPITATION (mm)

                                      Summary for MONTH  1989/11/

                                      Data interval:    60 mins

   DAY        SUM                     Interval Number
                                1       2       3       4       5       6       7       8       9      10      11      12
                               13      14      15      16      17      18      19      20      21      22      23      24


    2        2.90             0.00    0.00    0.00    0.00    0.30    0.00    0.10    0.00    0.20    0.40    0.50    0.50
                              0.80    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    3        0.30             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.30    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    4        0.10             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    5        2.40             0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.30    0.40    1.50    0.10

    6        4.10             3.30    0.70    0.00    0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    7       17.40             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.30    1.00    2.30    2.20    0.80
                              4.40    3.30    2.80    0.30    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
    8        1.10             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.10    0.70    0.10    0.00    0.00    0.20    0.00
    9        3.00             2.20    0.40    0.10    0.00    0.10    0.00    0.00    0.00    0.10    0.10    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   11        0.70             0.00    0.00    0.00    0.00    0.00    0.00    0.40    0.30    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   14        7.40             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    1.20    2.30    0.40    0.00
                              0.00    0.00    0.00    0.00    0.00    1.00    0.60    0.40    0.30    0.20    0.40    0.60
   15       40.00             1.70    1.10    0.60    2.50    0.60    0.00    0.00    0.00    0.10    3.70    5.90    0.20
                              0.00    0.00    0.00    0.00   10.30    6.30    1.00    1.30    1.50    1.80    0.20    1.20

   16        3.00             0.80    0.50    0.20    0.70    0.60    0.00    0.00    0.20    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   20        2.30             0.00    0.60    0.10    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.70    0.70    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00

   26        0.80             0.00    0.00    0.70    0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   27        9.60             0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.10    0.00    0.00    1.80    1.00    5.00    1.70
   28        0.10             0.00    0.10    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                              0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
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MONTH  SUM : 9.52000E+01

                              DAILY PRECIPITATION (mm)

                            Summary for MONTH  1989/12/

                            Data interval:    60 mins

 DAY        SUM             Interval Number
                        1       2       3       4       5       6       7       8       9      10      11      12
                       13      14      15      16      17      18      19      20      21      22      23      24

   5        0.33     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.33    0.00    0.00
                     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

   6        0.25     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.00    0.00    0.25    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
   7        0.28     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.00    0.28    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  11        0.20     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.20    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  27        0.51     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.51    0.00    0.00    0.00    0.00
  28        0.79     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.25    0.28    0.25
  29        0.76     0.25    0.00    0.25    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.25    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  30        1.60     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
                     0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.56    0.79    0.25

  31        7.31     0.25    0.25    0.51    0.53    1.07    1.30    1.07    0.51    0.25    0.00    0.00    0.51
                     0.79    0.00    0.00    0.28    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
MONTH  SUM : 1.20350E+01
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                              DAILY PRECIPITATION (mm)

                    Annual data display: Summary for period ending 1989/12

 Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

   1       0.00      0.00      0.00      0.00      0.00      1.10      0.00      0.00      5.70      0.00      0.00      0.00
   2       0.00      0.00      0.00      2.10      0.40      8.10      0.00      0.00      0.00      1.70      2.90      0.00
   3       0.00      0.00      0.00      8.80      0.00      2.60      0.00      0.00      0.00      0.40      0.30      0.00
   4       0.76      0.00      1.82      5.90      0.00      0.10      0.00      7.90      0.00      0.00      0.10      0.00
   5       0.00      0.00      0.00      3.40      8.50      0.00      0.00      0.00      0.00      2.20      2.40      0.33

   6       0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      1.90      1.40      4.10      0.25
   7       1.79      0.00      0.00      0.00      0.00      0.00      0.00      0.10      4.40      2.10     17.40      0.28
   8       4.89      0.00      0.00      0.00      0.00      2.30      0.00      0.00      0.10      0.10      1.10      0.00
   9       0.00      0.00      0.00      0.00      0.00     20.90      0.00      0.80      0.20      0.00      3.00      0.00
  10       0.00      0.00      0.00      0.00      0.10      0.00      0.00      0.10      0.00     31.80      0.00      0.00

  11       0.00      0.00      0.00      0.00      3.10      0.00      0.00      0.00      0.00      0.20      0.70      0.20
  12       2.34      0.00      0.00      2.80      8.00      0.60      1.30      0.00      0.00      0.00      0.00      0.00
  13       0.00      0.79      0.00      3.70      0.00      0.00      0.10      0.00      0.30      0.00      0.00      0.00
  14       3.93      1.07      0.00      6.50      0.00      0.00      0.00      0.00      3.30      0.00      7.40      0.00
  15       0.00      0.00      0.00      1.30      0.00      0.00      0.00     25.80      0.10      0.00     40.00      0.00

  16       0.00      0.00      0.00      0.00      0.00      1.50      0.00      0.10      6.80      1.20      3.00      0.00
  17       0.00      0.00      0.00      5.70      0.00     12.70      0.00      0.00      0.60      5.50      0.00      0.00
  18       0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.50      0.00      0.00
  19       0.00      0.00      0.00      0.00      0.00      5.10     27.20      0.00      0.00      2.10      0.00      0.00
  20       0.51      0.00      0.00      0.00      5.10      1.00      4.40      0.10      0.00      4.40      2.30      0.00

  21       0.00      5.49      0.00      0.00      0.00      2.90      0.00      0.10      0.00      4.90      0.00      0.00
  22       0.00      0.25      0.00      0.00      0.00     16.90      0.00      1.30      2.60      0.00      0.00      0.00
  23       0.00      0.00      0.00      0.00      5.40      0.00      0.00      0.00      1.30      0.00      0.00      0.00
  24       0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
  25       0.00      0.00      0.00      0.00      5.60      0.00      1.80      0.00      0.00      0.10      0.00      0.00

  26       8.47      2.34      0.00      4.70     15.50      0.80      0.00      0.00      0.00      0.00      0.80      0.00
  27       0.00      3.38      0.30      0.00      0.00      0.00     14.30      0.00      0.00      0.00      9.60      0.51
  28       0.00      0.00      3.60      0.00      0.00      0.00      0.00      0.90      0.00      0.00      0.10      0.79
  29       1.57                0.00      4.40      0.00      0.00      0.00      2.30      0.00      0.00      0.00      0.76
  30       0.23                0.00      0.00     24.20      0.00      0.20      0.00      0.00      0.00      0.00      1.60
  31       0.00                0.00                4.80                0.00      0.80                0.70                7.31
0 SUM     24.50     13.31      5.72     49.30     80.70     76.60     49.30     40.30     27.30     59.30     95.20     12.04

 SUM  of monthly values  5.33553E+02
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AIR TEMPERATURE (C)

Annual data display: Summary for period ending 1989/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-4.3	1.1	-8.7	1.2	7.9	19.9	21.0	20.9	19.0	13.7	3.8	-7.1
2	-2.6	-9.0	-11.7	3.9	7.0	19.0	23.4	23.4	15.1	15.5	2.5	-2.7
3	-8.0	-10.2	-9.3	6.3	6.6	17.6	24.3	25.0	15.7	5.2	-1.3	-12.4
4	-17.8	-10.8	-1.3	6.9	11.4	15.1	21.0	23.0	15.9	6.9	-1.0	-11.0
5	-11.1	-10.3	-4.9	4.9	11.7	13.9	22.7	24.6	19.1	9.6	8.2	-5.6
6	-5.5	-9.1	-10.6	2.1	6.0	16.8	23.7	17.2	19.0	11.0	7.6	-2.5
7	-0.2	-10.6	-16.3	1.4	1.5	20.9	21.8	11.0	20.3	4.7	2.3	-10.1
8	-1.4	-11.1	-10.5	1.6	6.3	21.1	19.9	13.6	22.6	3.7	3.4	-9.2
9	-10.3	-13.8	-4.2	-2.0	10.2	18.0	23.2	17.6	22.6	3.5	4.2	-9.3
10	-2.7	-9.6	-1.9	-4.0	9.5	21.1	24.3	19.7	17.8	5.5	3.1	-3.0
11	-6.3	-4.6	1.8	2.7	7.1	17.8	20.5	21.2	17.7	8.8	4.1	-7.5
12	1.1	-5.3	-3.3	1.1	9.1	15.5	18.0	20.8	17.6	13.3	1.0	-11.2
13	-6.7	-2.8	-2.3	0.5	9.5	15.3	18.0	20.3	11.9	13.7	8.9	-12.3
14	-4.0	0.7	4.9	4.9	10.5	13.7	16.3	21.0	10.5	12.0	12.4	-12.1
15	-1.4	-0.7	2.2	5.9	11.3	15.0	17.2	19.2	12.4	11.2	13.1	-12.7
16	-2.7	-9.1	-1.8	6.8	16.2	14.1	19.6	17.9	12.7	15.4	0.4	-11.2
17	-0.5	-10.7	-3.9	7.4	19.6	13.2	20.6	16.6	15.9	2.4	-5.4	-14.3
18	0.9	-10.8	-5.0	1.2	21.1	18.7	22.2	15.5	15.4	1.3	-5.5	-14.6
19	0.5	-5.5	-6.5	3.7	20.5	19.4	20.6	18.2	15.0	1.6	-3.2	-11.5
20	-5.7	-1.3	-2.6	7.6	16.3	17.4	17.6	19.3	16.7	2.3	3.2	-15.0
21	-10.6	-0.6	-5.4	6.9	15.5	17.2	20.1	20.0	18.3	1.8	-6.7	-16.8
22	-1.2	-5.4	-5.4	2.6	17.2	20.4	23.0	18.5	19.4	6.7	-6.4	-17.9
23	2.3	-16.2	-1.3	3.1	13.3	22.6	25.1	18.3	5.6	9.6	-7.8	-14.8
24	2.4	-15.1	0.8	6.7	15.4	23.8	25.9	16.0	6.0	13.9	-4.9	-15.4
25	-4.1	-9.6	4.5	12.5	18.6	23.7	23.7	14.6	9.0	14.1	2.6	-10.6
26	0.8	-4.4	4.4	11.1	18.3	23.5	25.2	16.9	7.9	15.7	2.0	-14.4
27	-1.6	-7.2	12.9	12.5	10.0	22.0	22.2	18.9	5.6	14.5	2.8	-12.3
28	2.0	-6.3	16.1	10.1	11.6	15.8	17.5	20.2	11.0	15.0	0.5	-7.9
29	2.0		3.2	6.3	16.0	14.9	18.6	21.3	13.3	14.7	-7.8	-8.1
30	2.0		1.8	9.0	19.5	18.3	19.5	18.2	11.9	14.3	-3.2	-7.8
31	5.4		0.4		21.0		20.0	19.2		10.4		0.1
AVER	-2.9	-7.4	-2.1	4.8	12.8	18.2	21.2	19.0	14.7	9.4	1.1	-10.4

AVER of monthly values 6.53541E+00

AIR TEMPERATURE (C)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	-3.8	0.9	-3.9	5.2	11.1	17.0	18.6	20.2	20.3	8.9	11.3	3.2
2	-3.3	-5.0	0.4	3.5	5.4	20.7	16.9	15.8	20.0	11.1	14.4	0.6
3	-0.3	-8.1	-7.7	2.4	8.0	17.0	19.1	17.5	14.2	15.3	14.2	-1.0
4	1.7	-7.7	-8.9	2.7	7.3	7.1	21.4	20.6	17.0	14.1	7.8	-2.9
5	-3.8	-3.2	-9.6	0.1	9.6	7.2	26.7	21.1	20.7	15.5	3.6	-4.2
6	-5.6	1.6	-10.1	-2.5	8.4	11.3	18.8	17.9	18.4	19.3	2.0	0.6
7	-1.8	0.4	-9.0	-1.7	13.6	16.9	15.3	15.4	17.5	16.5	1.0	-1.5
8	-1.7	3.7	-3.8	2.6	15.6	17.6	16.6	16.5	12.2	7.9	-0.3	0.3
9	1.0	4.8	0.3	9.0	18.5	15.5	20.5	16.4	15.5	6.2	0.9	1.8
10	-1.1	-1.7	2.6	5.6	9.7	19.4	21.5	19.4	19.2	7.5	2.7	1.1
11	-0.8	-4.0	2.4	0.0	4.8	14.2	18.8	19.4	16.4	7.0	-0.2	-2.7
12	-7.0	-3.3	10.0	-2.7	7.7	17.3	17.4	16.8	18.6	6.9	-0.6	3.0
13	-8.2	3.6	16.2	1.8	9.4	16.7	17.0	17.1	20.2	9.5	-1.4	0.1
14	-5.3	-5.1	15.5	3.9	12.7	21.1	17.8	16.1	18.2	9.9	1.9	-6.1
15	0.6	-5.9	16.6	4.5	16.0	22.1	18.1	19.0	10.6	9.8	11.1	-1.5
16	0.5	-2.6	10.7	4.5	14.0	20.4	19.2	21.1	9.0	9.3	9.6	0.2
17	5.3	-10.8	6.8	0.6	12.8	23.4	19.9	21.7	5.5	16.2	1.1	-0.3
18	0.5	-7.9	0.1	2.5	8.3	24.7	20.9	21.5	8.8	10.0	-1.3	2.2
19	-4.8	-4.2	-2.7	8.7	8.0	19.9	22.5	13.6	10.0	2.2	0.1	-1.3
20	-3.4	-7.4	-3.7	10.3	7.7	14.2	19.9	14.5	11.7	4.8	2.6	-2.4
21	-3.2	-1.7	1.4	10.1	8.7	17.4	21.8	15.8	12.2	10.6	3.3	3.4
22	-1.3	2.4	5.8	11.8	11.1	20.6	19.8	17.5	13.1	7.4	8.5	7.4
23	-2.6	-2.2	-2.7	15.5	12.4	18.8	18.8	19.1	8.1	5.7	3.3	-3.4
24	2.4	-7.7	-5.2	16.7	13.3	14.6	15.6	18.8	7.4	6.7	-0.5	-11.1
25	0.5	-16.9	-1.2	22.1	14.9	11.4	18.6	20.9	11.2	3.1	3.0	-9.6
26	-3.0	-12.2	-4.0	22.4	16.0	17.3	19.3	22.5	13.9	1.6	0.7	-14.4
27	2.0	-3.7	-3.7	22.2	17.5	19.4	20.7	23.6	14.1	5.8	13.8	-12.5
28	-1.9	-8.4	1.7	22.2	18.0	17.5	21.6	20.7	17.8	1.8	9.9	-2.4
29	-2.7		0.6	18.2	12.5	15.1	21.8	17.4	13.6	2.0	-0.9	5.3
30	-3.0		3.1	16.4	10.8	18.6	22.9	17.4	10.0	7.7	0.4	-1.2
31	-2.8		4.2		14.5		23.5	18.6		7.3		-9.5
0 AVER	-1.8	-4.0	0.7	8.0	11.6	17.2	19.7	18.5	14.2	8.6	4.1	-1.9

AVER of monthly values 7.89716E+00

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                              AIR TEMPERATURE (C)

           Annual data display: Summary for period ending 1991/12

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1       -4.4    -8.1     4.8     0.9    11.1    20.1    18.0    22.9    12.4    14.8     6.8     1.2
  2       -3.4     0.5     8.3    -0.6     6.8    19.6    19.3    20.0    15.2    18.9     2.2    -2.5
  3       -8.7     2.1    -4.0     2.4     5.7    18.3    20.2    17.2    19.2    15.2     5.0    -3.1
  4       -9.3     4.2    -4.0     8.8     8.0    14.0    20.3    16.8    17.1    11.4     5.9    -7.3
  5       -6.3     2.5    -0.9    11.1     9.6    16.2    21.2    15.8    17.4    14.3     4.5    -8.5

  6       -4.8     1.4     3.4    14.4     9.9    17.7    23.3    17.5    19.3     5.1     1.4    -4.9
  7      -11.3     0.8    -5.5    18.6     7.8    19.0    23.2    19.1    19.2     4.8     4.9     3.2
  8      -11.7     0.5    -5.6    17.9     8.0    20.6    19.1    18.0    21.4    10.0     5.2     6.6
  9       -2.3     0.7    -2.4    15.2    11.8    21.3    16.8    18.0    20.6    15.0     3.8     2.6
 10       -7.9    -3.6    -2.8     2.7    15.3    22.6    19.3    18.7    20.3     9.9     3.2     1.3

 11       -7.3    -9.7    -8.2     1.3    18.8    18.9    19.8    18.9    14.3     6.2     1.4     1.7
 12       -5.9    -8.4    -6.2     2.1    23.1    16.0    19.7    19.0    14.6     6.0     0.6     3.0
 13       -7.3    -3.7    -2.7     3.6    22.4    14.0    18.1    20.1    16.5     4.0     1.6     5.6
 14       -0.4    -4.0    -0.1     4.1    22.4    18.6    18.2    22.7    18.9     6.2     4.7    -1.0
 15        0.7   -13.8     1.0     7.6    21.6    22.8    19.4    21.0    24.3     5.6     7.8    -7.1

 16        0.8   -13.1     1.7     8.6    23.6    19.7    21.8    19.7    24.5     4.1     2.6   -10.6
 17       -1.8    -4.4     3.5     4.0    15.4    21.1    23.5    22.5    16.0    10.1     2.9    -4.9
 18       -3.2    -1.9     2.4     4.8     8.6    20.4    24.4    20.7    15.0     9.1     5.1   -10.2
 19        0.2     3.3     2.5     6.7    11.8    22.9    26.0    19.7     9.5     2.9    11.8   -13.5
 20       -2.8    -0.9     3.0     4.1    14.5    23.3    25.8    18.5     6.8     3.5     9.4    -4.3

 21      -16.8     2.5     2.9     3.6    18.8    21.8    24.1    16.0     7.9     7.7     3.1    -0.6
 22      -13.4    -1.7     0.3     5.2    22.6    14.8    23.6    18.0    11.8    11.6     2.3    -2.0
 23       -6.5   -10.4     7.8     8.7    23.7    16.5    22.9    20.1    12.4    16.1     5.0    -0.5
 24      -11.9    -3.5     2.2     9.2    22.0    18.6    20.4    19.1     8.2    16.2    -1.8    -5.6
 25      -14.6    -3.3     1.2    11.3    21.3    21.1    18.9    16.3     9.3    16.1    -2.3    -3.7

 26      -11.4    -8.8     4.1    13.4    20.1    22.7    15.8    19.3     7.1    16.5    -3.6    -3.4
 27       -6.8    -7.3    12.3    15.4    22.2    24.0    15.6    22.9     4.4    11.3    -0.3    -1.6
 28       -4.6    -4.5     5.3    12.3    23.5    25.9    17.1    23.5     5.9     6.0     1.4    -6.3
 29       -5.0             -3.3    14.6    23.6    25.3    18.5    23.7     7.4     5.9     0.5     0.4
 30       -6.6             -4.3    17.0    23.7    19.6    18.1    25.0    11.2     8.1     7.6    -5.7
 31       -9.5             -0.3            22.3            19.6    18.0             7.9            -7.1
^ AVER    -6.6    -3.3     0.5     8.3    16.8    19.9    20.4    19.6    14.3     9.7     3.4    -2.9

AVER of monthly values  8.34786E+00
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                              WIND SPEED (M/S)

           Annual data display: Summary for period ending 1989/12

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1        3.1     5.8     7.1     3.8     2.0     3.1     1.2     1.6     3.2     2.1     5.0     1.7
  2        7.3     4.9     3.0     5.4     3.6     4.4     1.0     3.7     2.0     4.0     2.2     6.2
  3        4.2     4.7     7.3     3.3     3.7     4.0     1.6     4.4     1.3     3.4     6.1     6.4
  4        2.2     2.8     2.7     3.6     4.1     4.1     1.4     3.6     2.4     4.0     2.7     2.9
  5        4.4     2.8     6.1     3.4     5.4     1.9     2.0     2.4     3.2     3.3     4.7     2.5

  6        5.6     4.0     5.7     3.5     4.7     3.7     1.9     3.8     1.2     3.8     4.3     4.9
  7        4.2     5.8     5.7     3.1     6.4     4.0     2.9     2.7     1.6     2.5     1.7     2.6
  8        9.8     9.1     3.1     1.8     4.8     1.5     1.9     2.1     2.7     2.3     3.4     1.9
  9        6.3     8.2     1.2     1.8     2.2     2.6     3.3     2.7     3.6     1.2     4.8     3.4
 10        6.3     7.3     2.1     1.8     4.0     1.5     4.5     2.3     2.7     3.5     3.0     3.7

 11        4.6     6.4     2.5     4.2     5.9     2.2     2.7     1.3     0.9     3.3     7.1     1.9
 12        6.1     4.6     4.4     2.9     2.7     3.4     1.7     0.8     1.3     3.5     2.8     0.5
 13        5.3     5.3     2.8    12.4     3.9     4.0     2.4     1.5     1.4     1.7     5.3     1.1
 14        3.7     3.3     3.7    19.1     2.7     3.2     3.6     2.3     2.6     2.6     4.4     3.0
 15        6.0     2.4     5.9     7.6     0.9     2.5     1.5     2.3     1.3     1.7     5.2     3.8

 16        5.1     4.7     6.0    12.0     2.9     3.2     1.0     2.1     2.9     4.1     8.3     5.1
 17        6.6     3.6     4.3    17.3     2.9     3.7     1.9     1.5     2.1     3.5     7.4     4.3
 18        4.6     2.4     0.0     9.2     1.5     4.0     2.2     2.3     0.8     3.6     6.4     3.7
 19        6.1     5.2     0.0     7.8     2.7     1.7     2.1     1.2     1.1     6.5     6.3     2.3
 20        6.6     2.3     0.0     4.0     3.9     1.8     4.4     2.9     0.8     2.4     8.4     6.3

 21        3.9     3.1     0.0     3.7     5.2     2.4     2.9     2.8     1.3     2.3     6.0     4.8
 22        6.5     4.4     0.9     3.8     2.8     1.7     1.3     2.1     3.1     3.1     1.1     2.0
 23        4.9     5.6     3.0     3.5     3.2     1.5     0.8     2.3     5.4     2.7     2.7     2.3
 24        2.7     1.7     2.6     2.4     2.5     1.6     0.9     1.9     1.6     1.6     4.6     5.1
 25        7.5     3.0     3.1     1.9     3.6     1.6     1.6     1.8     1.9     1.5     5.8     7.5

 26        4.1     1.7     3.5     2.2     5.4     2.2     2.3     1.0     3.9     1.4     3.4     5.2
 27        5.0     3.5     4.8     1.9     4.3     2.8     2.7     0.8     1.1     1.3     4.2     3.1
 28        5.7     3.1     6.8     2.4     3.1     4.6     3.3     0.9     3.3     1.7     6.9     3.5
 29        3.7             4.7     4.5     3.9     2.5     1.0     3.1     3.5     1.7     5.1     4.8
 30        5.8             3.7     2.4     3.4     1.3     0.8     2.9     1.0     2.3     6.3     3.5
 31        8.0             5.0             4.5             2.0     2.3             3.7             4.2
0 AVER     5.3     4.3     3.6     5.2     3.6     2.8     2.1     2.2     2.2     2.8     4.9     3.7

AVER of monthly values  3.56120E+00
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WIND SPEED (M/S)

Annual data display: Summary for period ending 1990/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.6	4.7	6.9	2.0	23.0	4.1	2.5	4.0	1.8	3.6	2.1	6.7
2	7.4	3.5	6.5	3.2	10.8	6.3	3.8	4.0	2.3	2.8	5.0	3.3
3	5.7	4.1	5.2	3.0	7.5	8.2	2.2	1.7	1.3	3.8	4.0	6.0
4	6.1	2.7	2.4	6.5	5.5	12.7	4.5	0.5	1.8	5.9	3.5	9.0
5	2.8	6.8	3.5	4.9	5.1	4.1	6.1	0.8	2.0	5.1	6.2	5.6
6	3.5	3.4	3.5	2.3	3.7	2.9	2.7	10.2	1.6	5.3	5.8	4.6
7	6.2	2.3	3.4	3.9	5.3	4.8	2.5	9.7	3.1	2.8	3.6	4.4
8	3.6	6.1	3.0	4.3	5.4	2.4	1.1	7.9	1.8	3.2	1.7	3.3
9	3.8	4.2	1.7	6.2	5.1	2.6	3.8	2.4	0.7	3.8	2.7	5.6
10	3.5	4.9	1.8	3.9	9.2	4.4	2.7	0.8	2.3	5.3	3.2	4.4
11	8.3	1.3	3.0	5.8	6.1	4.9	5.9	1.2	1.0	1.9	7.0	2.6
12	7.0	3.1	3.3	3.5	3.6	2.4	20.8	0.9	1.4	1.0	5.3	4.7
13	5.4	6.2	4.4	3.9	3.2	4.2	3.2	1.5	1.3	1.4	3.6	7.0
14	3.1	4.6	3.1	4.7	2.1	5.7	2.2	1.6	3.5	2.3	4.2	1.9
15	4.1	25.1	2.6	4.3	1.6	3.4	4.4	2.7	3.2	4.1	6.3	2.6
16	1.7	15.6	3.0	3.6	3.1	3.5	16.5	1.2	2.5	2.3	6.6	4.2
17	4.4	20.3	5.2	6.5	6.6	1.5	7.6	2.0	2.5	4.7	3.8	2.6
18	4.8	19.0	5.7	5.2	6.6	4.4	9.3	1.4	1.4	8.2	1.3	4.0
19	2.8	24.7	3.9	4.8	3.2	11.5	3.6	4.0	4.4	3.9	0.7	3.4
20	2.1	14.1	3.5	3.6	5.2	6.9	7.3	3.0	2.1	2.3	1.6	4.3
21	4.3	8.2	3.1	6.0	3.1	6.0	2.4	3.1	1.3	3.7	2.9	1.6
22	6.0	2.5	5.9	4.4	2.2	4.7	2.6	2.4	3.4	1.8	3.8	3.6
23	3.7	0.6	6.4	3.1	2.2	2.7	2.0	1.7	4.1	1.7	5.8	3.4
24	5.6	0.3	2.6	6.3	1.1	5.4	1.4	0.6	9.8	2.2	4.9	5.6
25	6.9	1.7	5.5	15.0	1.2	3.8	2.6	1.0	10.3	3.9	4.8	8.1
26	6.2	4.2	5.5	6.1	1.7	3.0	1.0	1.9	2.1	2.4	3.5	6.4
27	7.1	5.2	3.0	2.8	0.9	4.4	0.7	2.2	1.5	4.4	6.4	3.1
28	5.6	3.8	1.6	4.0	1.1	2.5	0.8	2.7	1.9	5.2	7.7	3.8
29	3.1		4.4	2.9	3.3	2.2	0.7	1.9	2.1	2.1	5.5	4.0
30	4.1		2.6	3.8	4.0	3.2	0.7	1.1	2.7	2.7	5.5	1.3
31	2.2		2.2		3.3		1.1	0.6		2.7		11.7
AVER	4.7	7.3	3.8	4.7	4.7	4.6	4.2	2.6	2.7	3.4	4.3	4.6

AVER of monthly values 4.30271E+00

WIND SPEED (M/S)

Annual data display: Summary for period ending 1991/12

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	22.3	0.2	0.2	0.3	0.5	0.1	0.1	0.2	17.5	0.5	5.2	16.0
2	14.0	0.2	0.2	0.2	0.9	0.1	0.1	0.2	12.3	1.8	6.8	26.8
3	19.8	0.2	0.2	0.2	0.7	0.1	0.1	0.2	1.1	0.6	4.3	18.9
4	21.9	0.2	0.2	0.4	0.1	0.1	0.2	0.7	2.3	2.8	1.8	18.3
5	5.7	0.2	0.2	0.4	0.1	0.1	0.1	0.2	0.4	6.2	0.5	17.3
6	6.0	0.2	0.2	0.2	0.2	0.9	0.1	0.8	0.2	5.0	1.3	16.5
7	13.0	0.2	0.2	0.3	0.9	0.5	0.1	0.2	0.2	3.1	0.7	25.3
8	7.2	0.2	0.2	0.2	0.7	1.7	0.1	6.0	0.3	3.0	1.7	17.8
9	0.2	0.2	0.2	0.2	0.1	1.2	0.1	0.2	1.2	4.9	0.8	15.0
10	0.2	0.2	0.2	0.4	0.1	2.5	0.1	0.2	4.9	2.3	1.8	18.9
11	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	2.1	1.1	3.7	12.5
12	0.2	0.2	0.2	0.1	0.2	0.4	0.2	1.0	0.9	2.7	2.0	20.9
13	0.2	0.2	0.2	0.1	0.7	0.1	0.2	0.1	0.7	1.0	5.5	14.0
14	0.2	0.2	0.2	0.1	0.3	0.1	0.2	0.2		0.0	2.2	25.9
15	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	[illegible]	4.0	5.1	31.0
16	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.4	4.8	3.0	4.7	17.7
17	0.2	0.2	0.2	0.1	0.1	0.1	1.0	0.8	1.6	3.1	1.2	26.0
18	0.4	0.2	0.2	0.1	0.1	0.1	1.7	0.2	0.6	3.7	2.5	17.0
19	0.2	0.2	0.2	0.1	0.1	0.1	3.3	0.9	0.2	3.7	4.2	6.0
20	0.2	0.2	0.2	0.1	0.1	0.1	2.7	1.7	0.3	2.5	3.6	12.0
21	0.2	0.2	0.2	0.1	0.1	0.1	3.8	1.1	0.6	4.4	1.7	21.2
22	0.3	0.2	0.2	0.1	0.1	0.1	3.1	0.2	2.6	2.9	7.9	23.9
23	0.2	0.2	0.2	0.2	0.1	0.1	4.8	2.6	0.4	4.1	13.8	18.5
24	0.2	0.2	0.2	0.2	0.1	0.1	1.9	1.2	1.0	4.8	35.0	14.8
25	0.2	0.2	0.2	0.2	0.1	0.1	3.1	0.3	2.4	5.3	28.8	10.1
26	0.2	0.2	0.2	0.2	0.1	0.1	1.6	0.2	1.4	2.2	17.5	12.3
27	0.3	0.2	0.2	0.2	0.1	0.1	1.2	5.0	0.1	4.0	25.6	1.6
28	0.2	0.2	0.2	0.1	0.1	0.1	0.7	5.8	0.1	6.4	18.5	6.8
29	0.2		0.2	0.1	0.1	0.1	0.7	4.2	1.2	5.8	17.1	8.9
30	0.2		0.2	0.1	0.1	0.1	0.2	7.8	0.8	2.4	34.0	11.3
31	0.2		0.2		0.1		0.5	16.3		2.0		7.7
0 AVER	3.7	0.2	0.2	0.2	0.2	0.3	1.0	1.9	2.1	3.2	8.6	16.5

AVER of monthly values 3.18729E+00

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                                   SOLAR RADIATION (LY/D)

                        Annual data display: Summary for period ending 1989/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1       356.      72.     325.     477.     235.     290.     695.     439.     110.     312.      92.     154.
    2        20.      19.     301.     239.     285.     491.     664.     465.     456.     119.      53.      94.
    3        70.     204.     161.     158.     233.     446.     546.     533.     449.     213.     232.     159.
    4       202.      67.      60.     182.     553.     617.     211.     150.     486.     350.      81.      79.
    5       109.     187.     199.     128.     185.     392.     559.     452.     339.     304.     105.     106.

    6        84.     197.     281.     125.     472.     635.     627.     429.     143.     119.      59.      21.
    7        60.     202.     449.     277.     154.     579.     559.     380.     275.     188.      17.     106.
    8        97.     200.     445.     422.     233.     526.     570.     366.     281.     200.      29.     128.
    9       145.     234.     393.     404.     331.     186.     583.     343.     271.     212.      75.     106.
   10        93.     236.     437.     396.     202.     512.     436.     524.     161.      10.      89.      45.

   11       149.     234.     282.     180.     321.     186.     611.     353.     345.     272.      67.     103.
   12        26.     290.     464.     173.      77.     282.     427.     408.     441.     302.      91.     112.
   13       143.      41.     329.     355.     288.     321.     420.     421.      53.     302.     185.     152.
   14       118.     218.     320.     356.     306.     135.     624.     505.     111.     230.      45.     114.
   15        84.      79.     115.     338.     331.     205.     624.     250.     460.     187.      17.      69.

   16       127.     252.     379.     589.     463.     194.     503.     444.      60.     240.      68.     132.
   17       103.     197.     161.      83.     585.     299.     636.     563.     370.      22.     155.     164.
   18       142.     242.     314.     347.     524.     589.     571.     536.     442.      64.     154.     159.
   19        79.     201.     459.     449.     446.     377.     278.     389.     265.      33.     107.     108.
   20       142.      93.     270.     513.      71.     288.     155.     168.     402.      36.      49.     152.

   21       216.     121.     531.     579.     651.     218.     477.     473.     391.      57.     188.     124.
   22       205.     283.     531.     523.     624.     242.     413.     259.     161.     290.      59.     166.
   23       199.     386.     513.     604.     142.     501.     550.     278.     285.     261.     228.     137.
   24        88.     398.     285.     463.     618.     543.     553.     499.     280.     204.     183.     127.
   25       108.     178.     247.     249.     432.     650.     356.     547.     306.     221.     104.     108.

   26        30.     169.     412.     681.     526.     405.     484.     520.     329.     218.     142.     175.
   27        45.     375.     454.     249.     474.     346.     295.     432.     418.     233.      60.      97.
   28       188.     228.     188.     504.     691.     641.     515.     312.     402.     226.      29.     117.
   29        73.              182.     157.     645.     681.     570.     223.     394.     223.     124.      63.
   30        77.              145.     241.     465.     678.     557.     406.     401.     221.     130.      65.
   31       142.              115.              317.              608.     501.              81.               40.
SUM        3719.    5604.    9750.   10442.   11880.   12457.   15678.   12568.    9291.    5951.    3018.    3483.

SUM  of monthly values  1.03840E+05
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                                   SOLAR RADIATION (LY/D)

                        Annual data display: Summary for period ending 1990/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1       121.      41.     377.     105.     596.     642.     343.    -144.     364.     266.     218.      86.
    2       160.     128.     355.      43.     667.     439.     471.     606.     495.     373.     164.     165.
    3       149.     102.     314.      64.     506.     539.     659.     593.     507.     241.     195.      14.
    4        22.     249.     291.     434.     112.     470.     581.     605.     380.     274.      28.      79.
    5       129.     163.     386.     188.     411.     598.     580.     489.     327.     295.       5.      82.

    6        94.     237.     408.     425.     530.     617.     411.     437.     110.     346.     100.      39.
    7       128.     172.     415.     331.     508.     418.     661.     440.     306.     221.      38.     173.
    8       112.     188.     408.     520.     576.     684.     565.     269.     484.      38.     210.     115.
    9        72.      94.      60.     357.     452.     161.     461.    -747.     306.      41.      67.     162.
   10        85.     233.      90.      47.     286.     537.     615.     437.     301.      58.     127.     162.

   11        89.     230.      63.     475.     461.     266.     539.     440.     446.     119.      77.      28.
   12       138.     228.     264.     249.     200.     656.     448.     269.     439.      53.     160.     151.
   13       139.      93.     364.     333.     238.     338.     414.     276.     422.     223.     246.      62.
   14       111.     126.     317.      50.     545.     540.      70.     484.      93.     297.     240.     169.
   15       160.      77.     257.     268.     323.     273.     206.     451.     128.     273.     224.      12.

   16        78.      95.      60.     489.      52.     665.     532.     301.     324.     308.      90.      38.
   17        24.     361.     164.     359.     214.     605.     523.     434.     403.     254.     235.      22.
   18        16.     343.     193.     547.     210.     402.     455.     252.     420.      76.     234.       7.
   19       159.     282.     286.     537.     423.     595.     488.     122.      68.     164.     149.     100.
   20        53.     357.     390.     110.      69.     472.     261.     194.     249.     287.     160.     126.

   21        36.     314.     420.     385.     236.     364.     496.     221.     216.     266.      45.      14.
   22       105.      33.     116.     556.     508.     508.     163.     192.     180.     190.      17.      29.
   23       111.     139.     359.     484.     436.     204.     546.     402.     164.     164.      96.      63.
   24        39.     154.     275.     406.     489.     126.     102.     272.      42.     171.      61.     133.
   25        32.     364.     455.     558.     568.     131.     587.     381.     357.     106.      83.     104.

   26        69.     306.     356.     509.     389.     672.     506.     417.     250.     254.     164.     161.
   27       188.     145.     344.     504.     585.     506.     566.     543.     353.     209.      33.     115.
   28       178.     349.     432.     487.     562.     565.     599.     206.     318.      88.      36.      50.
   29        53.              213.     470.     309.     486.     562.     484.     103.     231.      67.       5.
   30       185.               36.     519.     681.     280.     508.     526.     149.     209.     171.      10.
   31       156.              102.              686.              558.     509.              180.              145.
0 SUM      3190.    5605.    8570.   10810.   12825.   13761.   14476.   10363.    8706.    6274.    3739.    2622.

SUM  of monthly values  1.00942E+05
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                                SOLAR RADIATION (LY/D)

                   Annual data display: Summary for period ending 1991/12

Day       JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

   1      124.      211.      216.      158.      256.      581.      463.      593.      572.      264.       65.       98.
   2      134.      233.       98.      211.      221.      503.      527.      331.      567.      300.       37.      110.
   3      126.      240.       45.      492.      401.      510.      308.       90.      420.      202.      166.       62.
   4      149.      233.      105.      417.      559.      479.      364.      320.      393.       15.      208.      184.
   5       57.       65.      386.      150.      525.      514.      455.      598.      394.      124.      123.      128.

   6      125.       48.       24.      185.      171.      440.      588.      537.      425.      268.       47.      157.
   7      210.       59.      261.      463.      212.      641.      523.      378.      352.      231.       99.       36.
   8      167.      193.      365.      197.      545.      635.      580.      420.      392.      329.      137.       21.
   9       55.      135.      131.      143.      299.      636.      665.      281.      214.      278.      236.       60.
  10      140.      209.      399.      162.      436.      553.      598.      470.      226.      285.      213.       82.

  11       57.      224.      446.      520.      557.      137.      598.      525.      416.       44.      101.      161.
  12       73.      199.      441.      482.      528.      565.      510.      318.      451.      186.       33.       41.
  13      112.      157.      347.      199.      542.      693.      267.      435.      165.      261.       68.       80.
  14       46.      145.      365.       73.      590.      661.      596.      525.      347.      110.      103.       29.
  15       75.      216.      378.       74.      639.      475.      646.      425.      310.      174.       31.      112.

  16       60.      295.      403.      532.      498.      228.      628.      315.      327.      310.      123.      117.
  17       95.      266.      283.      202.      152.      608.      554.      448.      336.      294.      185.       53.
  18      101.      154.       40.      387.      583.      572.      557.      226.      159.      263.       73.      188.
  19      195.       31.      266.      254.      672.      542.      521.      458.      321.      165.       26.      160.
  20       74.      135.      380.       26.      660.      652.      525.      392.      288.      253.       16.      108.

  21      166.      283.      348.       70.      619.      574.      280.      162.      254.      148.       95.      165.
  22      210.      160.      150.      362.      434.      202.      291.      456.      305.      228.      119.      178.
  23       66.      331.      277.      456.      610.      678.      605.      390.      373.      238.       38.       80.
  24      179.      271.       95.      240.      337.      648.      542.      486.      201.       75.       60.      124.
  25      199.      175.      118.      566.      356.      638.      509.      456.      358.       48.      134.      171.

  26      191.      276.      252.      341.      162.      550.      522.      512.      223.       62.       54.      117.
  27      183.      290.       52.      474.      362.      542.      533.      412.      184.       99.       90.      188.
  28      252.      126.      204.      328.      620.      608.      486.      516.      293.      229.       78.      119.
  29      125.                217.      254.      531.      405.      260.      495.      365.      229.       41.       65.
  30      151.                449.      458.      409.      246.      487.      472.      285.      207.      112.      198.
  31      190.                384.                467.                570.      580.                175.                184.
0 SUM    4090.     5359.     7925.     8876.    13954.    15716.    15557.    13021.     9916.     6094.     2912.     3575.

SUM  of monthly values  1.06996E+05
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APPENDIX B

HSPF User Controlled Input Files

```
UN
** PITTOCK TEST (GORING DRAIN) UCI  ***
LOBAL
 PITTOCK TEST WATERSHED
 <--8X--><--START-DATE/TIME-> *** <---END-DATE/TIME-->
 START       1989/01/01        END     1990/12/31
 RUN INTERP OUTPUT LEVEL    0
 RESUME     0 RUN     1 TSSFL    15
ND GLOBAL
**
PN SEQUENCE
    <-------19X-------> ***  <IDT>
    INGRP              INDELT 00:30
      <OPTYP AND ##>     ***
      PERLND     116
      PERLND     121
      PERLND     122
      PERLND     123
      PERLND     124
      PERLND     126
      PERLND     129
      PERLND     131
      PERLND     133
      PERLND     140
      PERLND     141
      PERLND     142
      PERLND     143
      PERLND     144
      PERLND     146
      PERLND     149
      PERLND     213
      PERLND     224
      PERLND     226
      PERLND     233
      PERLND     241
      PERLND     243
      PERLND     244
      PERLND     249
      PERLND     614
      PERLND     623
      PERLND     624
      PERLND     625
      PERLND     643
      PERLND     644
      PERLND     645
      PERLND     743
      PERLND     744
      RCHRES      71
      RCHRES      61
      RCHRES      52
      RCHRES      51
      RCHRES      41
      RCHRES      31
      RCHRES      21
      RCHRES      14
      RCHRES      13
      RCHRES      12
      RCHRES      11
      PLTGEN ***   1
    END INGRP
END OPN SEQUENCE
***
SPEC-ACTIONS
  OPERATIONS         DATE AND TIME   TYPE  VARIAB  SUBSCR  AC  QUANTITY  ***
  TYPE    #   #                      CODE                                ***
    ***
    ***
    ******  1 9 8 9  SPECIAL ACTIONS  ******
    ***
    ***
****************   JANUARY    ********************
***
*** DECREASE INFILT DUE TO FROZEN GROUND
  PERLND116 744      1989/01/01          3  JGER          1   2.50
  PERLND116 744      1989/01/01          3  INFILT        1   .009
  PERLND116 744      1989/01/01          3  KGW           1   .014
  PERLND116 744      1989/01/17          3  INFILT        1   .010
  PERLND116 744      1989/01/20          3  TSNOW         1     34.0
  PERLND116 744      1989/01/20          3  DEEPFR        1    .05
  PERLND116 744      1989/01/27          3  INFILT        1   .005
****************   FEBRUARY   ******************
  PERLND116 744      1989/02/01          3  KGW           1   .010
  PERLND116 744      1989/02/07          3  LZSN          1     6.0
  PERLND116 744      1989/02/08          3  INFILT        1   .002
  PERLND116 744      1989/02/08          3  KGW           1   .0030
  PERLND116 744      1989/02/10          3  MGMELT        1  .0003
  PERLND116 744      1989/02/13          3  KGW           1   .0020
  PERLND116 744      1989/02/15          3  SNOWCF        1     7.4
  PERLND116 744      1989/02/16          3  MGMELT        1  .0002
  PERLND116 744      1989/02/16          3  KGW           1   .0012
  PERLND116 744      1989/02/17          3  INFILT        1   .001
  PERLND116 744      1989/02/20          3  TSNOW         1     34.0
  PERLND116 744      1989/02/20          3  COVIND        1    500.0
****************     MARCH    ******************
  PERLND116 744      1989/03/01          3  JGER          1   1.50
  PERLND116 744      1989/03/01          3  CCFACT        1     1.7
  PERLND116 744      1989/03/10          3  MGMELT        1  .0005
  PERLND116 744      1989/03/10          3  LZSN          1     4.0
  PERLND116 744      1989/03/10          3  KGW           1   .006
  PERLND116 744      1989/03/10          3  INFILT        1     .027
  PERLND116 744      1989/03/12          3  JRER          1   2.20
  PERLND116 744      1989/03/20          3  KGW           1   .008
  PERLND116 744      1989/03/24          3  LZSN          1     3.0
  PERLND116 744      1989/03/31          3  TSNOW         1     30.0
**********************    APRIL     *********************
***
  PERLND116 744      1989/04/02          3  LZSN          1     2.0
  PERLND116 744      1989/04/10          3  INFILT        1    .030
  PERLND116 744      1989/04/17          3  KGW           1  .0060
  PERLND116 744      1989/04/20          3  LZSN          1     3.5
  PERLND116 744      1989/04/27          3  KGW           1  .0040
  PERLND116 744      1989/04/27          3  INFILT        1     .040
**********************    MAY     ************************
  PERLND116 744      1989/05/01          3  DEEPFR        1    .05
  PERLND116 744      1989/05/01          3  LZSN          1     5.0
  PERLND116 744      1989/05/06          3  KGW           1  .0020
  PERLND116 744      1989/05/10          3  INFILT        1     .030
  PERLND116 744      1989/05/12          3  DEEPFR        1    .60
  PERLND116 744      1989/05/25          3  KGW           1   .010
  PERLND116 744      1989/05/25          3  INFILT        1   .010
  PERLND116 744      1989/05/30          3  INFILT          1   .035
  PERLND116 744      1989/05/30          3  KGW             1    .007
********************** JUNE    *************************
  PERLND116 744      1989/06/02          3  LZSN            1    4.5
  PERLND116 744      1989/06/08          3  INFILT          1   .025
  PERLND116 744      1989/06/08          3  DEEPFR          1    .20
  PERLND116 744      1989/06/21          3  INFILT          1   .025
*********************** JULY    ************************
  PERLND116 744      1989/07/01          3  INFILT          1   .060
  PERLND116 744      1989/07/01          3  DEEPFR          1    .97
  PERLND116 744      1989/07/01          3  LZSN            1     6.0
********************** AUGUST ***************************
  PERLND116 744      1989/08/01          3  LZSN            1     8.0
********************* SEPTEMBER ************************
  PERLND116 744      1989/09/01          3  LZSN            1     9.0
********************* OCTOBER **************************
  PERLND116 744      1989/10/01          3  LZSN            1    10.0
*********************NOVEMBER************************
  PERLND116 744      1989/11/01          3  DEEPFR          1    .99
  PERLND116 744      1989/11/01          3  LZSN            1     6.0
  PERLND116 744      1989/11/14          3  INFILT          1   .100
  PERLND116 744      1989/11/15          3  TSNOW           1     31.5
  PERLND116 744      1989/11/15          3  LZSN            1     6.0
  PERLND116 744      1989/11/15          3  KGW             1    .015
  PERLND116 744      1989/11/21          3  INFILT          1   .070
  PERLND116 744      1989/11/25          3  DEEPFR          1    .95
*********************** DECEMBER ***************************
  PERLND116 744      1989/12/15          3  SNOWCF          1     4.0
  PERLND116 744      1989/12/20          3  MGMELT          1    .25
**  1990 SPECIAL ACTIONS   ***
**********************JANUARY*******************************
  PERLND116 744      1990/01/01          3  KGER            1   0.007
  PERLND116 744      1990/01/01          3  KSER      ***   1   2.00
  PERLND116 744      1990/01/01          3  TSNOW           1     28.0
  PERLND116 744      1990/01/01          3  DEEPFR          1    .02
  PERLND116 744      1990/01/01          3  CCFACT          1   2.00
  PERLND116 744      1990/01/01          3  LZSN            1     3.0
  PERLND116 744      1990/01/01          3  INFILT          1   .0050
  PERLND116 744      1990/01/01          3  KGW             1    .005
  PERLND116 744      1990/01/10          3  SKMP            1    .001
  PERLND116 744      1990/01/10          3  UKMP            1    .001
  PERLND116 744      1990/01/10          3  LKMP            1    .001
  PERLND116 744      1990/01/10          3  AKMP            1    .001
*********************FEBRUARY*******************************
  PERLND116 744      1990/02/01          3  LZSN            1     2.0
  PERLND116 744      1990/02/21          3  KSER            1   0.10
  PERLND116 744      1990/02/21          3  KRER     ***    1   0.05
  PERLND116 744      1990/02/21          3  TSNOW           1     34.0
*********************MARCH**********************************
  PERLND116 744      1990/03/01          3  LZSN            1     2.0
*********************APRIL**********************************
  PERLND116 744      1990/04/01          3  SKMP            1  .0000
  PERLND116 744      1990/04/01          3  UKMP            1  .0000
  PERLND116 744      1990/04/01          3  LKMP            1  .0000
  PERLND116 744      1990/04/01          3  AKMP            1  .0000
  PERLND116 744      1990/04/01          3  INFILT          1   .030
  PERLND116 744      1990/04/01          3  LZSN            1     2.0
  PERLND116 744      1990/04/01          3  KGW             1    .0030
*********************MAY************************************
  PERLND116 744      1990/05/01          3  DEEPFR          1    .80
  PERLND116 744      1990/05/01          3  LZSN            1     3.0
************************JUNE*********************************
  PERLND116 744      1990/06/01          3  DEEPFR          1    .90
  PERLND116 744      1990/06/01          3  LZSN            1     6.0
  PERLND116 744      1990/06/25          3  INFILT          1   .070
************************JULY*********************************
  PERLND116 744      1990/07/01          3  DEEPFR          1    .98
  PERLND116 744      1990/07/01          3  LZSN            1     5.0
*************************AUGUST******************************
  PERLND116 744      1990/08/01          3  LZSN            1     6.0
**************************SEPTEMBER**************************
  PERLND116 744      1990/09/01          3  LZSN            1     6.0
*************************OCTOBER*****************************
  PERLND116 744      1990/10/01          3  DEEPFR          1    .40
  PERLND116 744      1990/10/01          3  LZSN            1     5.0
  PERLND116 744      1990/10/01          3  INFILT          1   .020
**************************NOVEMBER***************************
  PERLND116 744      1990/11/01          3  KGER            1   0.050
  PERLND116 744      1990/11/01          3  LZSN            1     4.0
  PERLND116 744      1990/11/15          3  INFILT          1   .030
  PERLND116 744      1990/11/15          3  KGW             1    .010
**************************DECEMBER***************************
  PERLND116 744      1990/12/01          3  CMAXP           1    .000
  PERLND116 744      1990/12/01          3  LZSN            1     3.0
  PERLND116 744      1990/12/01          3  DEEPFR          1    .05
ND SPEC-ACTIONS
**
ERLND
  ACTIVITY
  < RANGE> ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  ***
  116  744           1    1    1    1              1              1
  116  744  ***      1    1    1
  116  744  ***      1    1
  END ACTIVITY
  PRINT-INFO
** 2-EACH PIVL,3-DAILY,4-MONTHLY,5-ANNUALLY,6-NEVER  ***
  < RANGE> ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC PIVL***YR
  116                6    6    4    6    6         6              4            12
  121                6    6    5    6    6         6              5            12
  122  744           6    6    6    6    6         6              6            12
  614       ***      6    3    6    6    3         3              3            12
  623  744  ***      6    6    6    6    6         6              6            12
  END PRINT-INFO
  GEN-INFO
  < RANGE><-PLS-ID (20 CHAR)-> NBLK   UU   IU   OU ENGL METR  ***
  116       1 %-HNYMD-CONV W/GR    1    2    2    2         6
  121       1 %-TSCLA-BUILDINGS    1    2    2    2         6
  122       1 %-TSCLA-IDLE/PAST    1    2    2    2         6
  123       1 %-TSCLA-CONV CORN    1    2    2    2         6
  124       1 %-TSCLA-REDCD CORN   1    2    2    2         6
  126       1 %-TSCLA-CONV W/GR    1    2    2    2         6
  129       1 %-TSCLA-CONV BEAN    1    2    2    2         6
  131       1 %-CRMBE-REDCD BEAN   1    2    2    2         6
  133       1 %-CRMBE-CONV CORN    1    2    2    2         6
  140       1 %-EMBRO-REDCD BEAN   1    2    2    2         6
  141       1 %-EMBRO-BUILDINGS    1    2    2    2         6
  142       1 %-EMBRO-IDLE/PAST    1    2    2    2         6
  143       1 %-EMBRO-CONV CORN    1    2    2    2         6
  144       1 %-EMBRO-REDCD CORN   1    2    2    2         6
  146       1 %-EMBRO-CONV W/GR    1    2    2    2         6
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 149      1 %-EMBRO-CONV BEAN     1     2     2     2           6
 213      3 %-HNYWD-CONV CORN     1     2     2     2           6
 224      3 %-TSCLA-REDCD CORN    1     2     2     2           6
 226      3 %-TSCLA-CONV W/GR     1     2     2     2           6
 233      3 %-CRMBE-CONV CORN     1     2     2     2           6
 241      3 %-EMBRO-BUILDINGS     1     2     2     2           6
 243      3 %-EMBRO-CONV CORN     1     2     2     2           6
 244      3 %-EMBRO-REDCD CORN    1     2     2     2           6
 249      3 %-EMBRO-CONV BEAN     1     2     2     2           6
 614      1 %-HNYWD-CONV SP/GR    1     2     2     2           6
 623      1 %-TSCLA-WOODLOT       1     2     2     2           6
 624      1 %-TSCLA-CONV SP/GR    1     2     2     2           6
 625      1 %-TSCLA-RED SP/GR     1     2     2     2           6
 643      1 %-EMBRO-WOODLOT       1     2     2     2           6
 644      1 %-EMBRO-CONV S/GR     1     2     2     2           6
 645      1 %-EMBRO-RED SP/GR     1     2     2     2           6
 743      3 %-EMBRO-WOODLOT       1     2     2     2           6
 744      3 %-EMBRO-CONV SP/GR    1     2     2     2           6
  END GEN-INFO
***
 *   START SNOW BLOCK  ***
  ICE-FLAG
    <PLS > ICE- ***
    # -  # FLAG ***
  111  973    0
  END ICE-FLAG
  SNOW-PARM1
    <PLS >  LATITUDE     MEAN-      SHADE     SNOWCF      COVIND***
    #    #               ELEV                                  ***
 *  BUILDINGS/HOMESTEADS
  121            43.15       275       0.80        1.0         50.
  131            43.15       275       0.80        1.0         50.
  141            43.15       275       0.80        1.0         50.
  241            43.15       275       0.80        1.0         50.
 *  WOODLOTS
  623            43.15       275       0.80        1.0         50.
  643            43.15       275       0.80        1.0         50.
  743            43.15       275       0.80        1.0         50.
 ***  ALL OTHER PLS'S
  116            43.15       275       0.90        1.0         70.
  122  129       43.15       275       0.90        1.0         70.
  133  140       43.15       275       0.90        1.0         70.
  142  233       43.15       275       0.90        1.0         70.
  243  614       43.15       275       0.90        1.0         70.
  624  625       43.15       275       0.90        1.0         70.
  644  645       43.15       275       0.90        1.0         70.
  744            43.15       275       0.90        1.0         70.
  END SNOW-PARM1
  SNOW-PARM2
    <PLS >***
    # -  #        RDCSN      TSNOW     SNOEVP     CCFACT     MWATER     MGMELT***
  116  744         0.15        0.0      0.20        0.70       .250       0.20
  END SNOW-PARM2
  SNOW-INIT1
    <PLS >***
    # -  # PACK-SNOW  PACK-ICE PACK-WATR     RDENPF       DULL     PAKTMP***
  116  614       34.0        0.        8.5        0.2       500.        0.0
  624            34.0        0.        8.5        0.2       500.        0.0
  625            34.0        0.        8.5        0.2       500.        0.0
  644            34.0        0.        8.5        0.2       500.        0.0
  645            34.0        0.        8.5        0.2       500.        0.0
  744            34.0        0.        8.5        0.2       500.        0.0
  *** Woodlots start with more snow pack       ***
  623            36.0        0.         9.        0.2       500.        0.0
  643            36.0        0.         9.        0.2       500.        0.0
  743            36.0        0.         9.        0.2       500.        0.0
  END SNOW-INIT1
  SNOW-INIT2
    <PLS >***
    # -  #      COVINX     XLNMLT     SKYCLR***
  116  744         50.        0.5
  END SNOW-INIT2
 **
 **  START PWATER BLOCK    ***
  PWAT-PARM1
 **  INTERCEPTION VARIES FOR ALL PLS'S---UPPER ZONE STORAGE AND MANNINGS
***  N VARY FOR TILLED FIELDS AND E-T VARIES FOR ALL PLS'S
  < RANGE> CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE  ***
  116         1    1    1    1    1    1    1    1    0
  121         1    1    1    1    0    0    1    0    0
  122         1    1    1    1    1    1    1    1    0
  123         1    1    1    1    1    1    1    1    0
  124         1    1    1    1    1    1    1    1    0
  126         1    1    1    1    1    1    1    1    0
  129         1    1    1    1    1    1    1    1    0
  131         1    1    1    1    0    0    1    0    0
  133         1    1    1    1    1    1    1    1    0
  140         1    1    1    1    1    1    1    1    0
  141         1    1    1    1    0    0    1    0    0
  142         1    1    1    1    1    1    1    1    0
  143         1    1    1    1    1    1    1    1    0
  144         1    1    1    1    1    1    1    1    0
  146         1    1    1    1    1    1    1    1    0
  149         1    1    1    1    1    1    1    1    0
  213         1    1    1    1    1    1    1    1    0
  224         1    1    1    1    1    1    1    1    0
  226         1    1    1    1    1    1    1    1    0
  233         1    1    1    1    1    1    1    1    0
  241         1    1    1    1    0    0    1    0    0
  243         1    1    1    1    1    1    1    1    0
  244         1    1    1    1    1    1    1    1    0
  249         1    1    1    1    1    1    1    1    0
  614         1    1    1    1    1    1    1    1    0
  623         1    1    1    1    0    0    1    0    1
  624         1    1    1    1    1    1    1    1    0
  625         1    1    1    1    1    1    1    1    0
  643         1    1    1    1    0    0    1    0    1
  644         1    1    1    1    1    1    1    1    0
  645         1    1    1    1    1    1    1    1    0
  743         1    1    1    1    0    0    1    0    1
  744         1    1    1    1    1    1    1    1    0
  END PWAT-PARM1
  PWAT-PARM2
  < RANGE><-FOREST-><--LZSN--><-INFILT-><--LSUR--><--SLSUR-><--KVARY-><***AGWRC>
***    1% SLOPE  ***
***  HONEYWOOD SERIES ***
   116          0.10      100.       2.0      120.0    0.01                 0.85
   614          0.05      100.       2.0      120.0    0.01                 0.85
***   TUSCOLA SERIES ***
   121          0.10      100.       2.0      120.0    0.01                 0.85
 122          0.05      100.      2.0      120.0    0.01                    0.85
 123          0.05      100.      2.0      120.0    0.01                    0.85
 124          0.05      100.      2.0      120.0    0.01                    0.85
 126          0.05      100.      2.0      120.0    0.01                    0.85
 129          0.05      100.      2.0      120.0    0.01                    0.85
 623          1.00      100.      2.0      120.0    0.01                    0.85
 624          0.05      100.      2.0      120.0    0.01                    0.85
 625          0.05      100.      2.0      120.0    0.01                    0.85
*  CROMBIE SERIES ***
 131          0.10      100.      0.8      120.0    0.01                    0.85
 133          0.05      100.      0.8      120.0    0.01                    0.85
***  EMBRO SERIES  ***
 140          0.05      100.      2.0      120.0    0.01                    0.85
 141          0.10      100.      2.0      120.0    0.01                    0.85
 142          0.05      100.      2.0      120.0    0.01                    0.85
 143          0.05      100.      2.0      120.0    0.01                    0.85
 144          0.05      100.      2.0      120.0    0.01                    0.85
 146          0.05      100.      2.0      120.0    0.01                    0.85
 149          0.05      100.      2.0      120.0    0.01                    0.85
 643          1.00      100.      2.0      120.0    0.01                    0.85
 644          0.05      100.      2.0      120.0    0.01                    0.85
 645          0.05      100.      2.0      120.0    0.01                    0.85
**  3% SLOPES
**  HONEYWOOD SERIES ***
 213          0.05      100.      2.0      100.0    0.03                    0.85
***   TUSCOLA SERIES ***
 224          0.05      100.      2.0      100.0    0.03                    0.85
 226          0.05      100.      2.0      100.0    0.03                    0.85
**  CROMBIE SERIES ***
 233          0.05      100.      0.8      100.0    0.03                    0.85
**  EMBRO SERIES ***
 241          0.10      100.      2.0      100.0    0.03                    0.85
 243          0.05      100.      2.0      100.0    0.03                    0.85
 244          0.05      100.      2.0      100.0    0.03                    0.85
 249          0.05      100.      2.0      100.0    0.03                    0.85
 743          1.00      100.      2.0      100.0    0.03                    0.85
 744          0.05      100.      2.0      100.0    0.03                    0.85
 END PWAT-PARM2
 PWAT-PARM3
 < RANGE><PETMAX   ><PETMIN   ><INFEXP   ><INFLD***><DEEPFR   ><BASETP   ><AGWETP   >
 116  614  4.5        1.7            2.0      2.0          0.05       0.00       0.00
 614                                 2.0      2.0          0.05       0.00       0.00
 624                                 2.0      2.0          0.05       0.00       0.00
 625                                 2.0      2.0          0.05       0.00       0.00
 644                                 2.0      2.0          0.05       0.00       0.00
 645                                 2.0      2.0          0.05       0.00       0.00
 744                                 2.0      2.0          0.05       0.00       0.00
 *** Woodlots contribute to groundwater ET ***
 623                                 2.0      2.0          0.05       0.10       0.0
 643                                 2.0      2.0          0.05       0.10       0.0
 743                                 2.0      2.0          0.05       0.10       0.0
 END PWAT-PARM3
 PWAT-PARM4
 < RANGE><--CEPSC-><--UZSN--><--NSUR--><--INTFW-><---IRC--><--LZETP->  ***
 116  744                    13.0      0.30       0.0      0.50      0.10
 END PWAT-PARM4
 MON-INTERCEP
   <PLS >  INTERCEPTION STORAGE CAPACITY AT START OF EACH MONTH***
   # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
***  CONVENTIONALLY TILLED AREAS  ***
 116          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 123          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 126          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 129          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 133          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 143          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 146          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 149          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 213          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 226          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 233          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 243          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 249          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 614          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 624          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 644          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 744          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
***   CONSERVATION TILLED AREAS  ***
 121          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 122          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 124          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 131          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 140          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 141          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 142          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 144          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 224          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 241          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 244          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 625          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 645          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 *** Woodlots provide interception throughout the year
 623          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 643          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 743          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 END MON-INTERCEP
 MON-UZSN
   <PLS >  MONTHLY UPPER ZONE STORAGE FOR ALL TILLED FIELDS ***
   # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
***   PASTURE    ****
 122          12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.
 142          12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.
***  CONVENTIONAL CORN  ***
 123           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 133           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 143           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 213           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 233           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 243           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
***   REDUCED TILL CORN  ***
 124           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 144           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 224           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 244           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
***   NO TILL CORN  ***
***  CONVENTIONAL WINTER GRAIN  ***
 116           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 126           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 146           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 226           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
```

```
RUN
* PITTOCK TEST (GORING DRAIN) UCI  ***
OBAL
 PITTOCK TEST WATERSHED
 <--8X--><--START-DATE/TIME-> *** <---END-DATE/TIME-->
 START        1989/01/01       END     1990/12/31
 RUN INTERP OUTPUT LEVEL    0
 RESUME     0 RUN     1 TSSFL    15
D GLOBAL
*
N SEQUENCE
   <-------19X-------> ***  <IDT>
   INGRP              INDELT 00:30
     <OPTYP AND ##>      ***
     PERLND     116
     PERLND     121
     PERLND     122
     PERLND     123
     PERLND     124
     PERLND     126
     PERLND     129
     PERLND     131
     PERLND     133
     PERLND     140
     PERLND     141
     PERLND     142
     PERLND     143
     PERLND     144
     PERLND     146
     PERLND     149
     PERLND     213
     PERLND     224
     PERLND     226
     PERLND     233
     PERLND     241
     PERLND     243
     PERLND     244
     PERLND     249
     PERLND     614
     PERLND     623
     PERLND     624
     PERLND     625
     PERLND     643
     PERLND     644
     PERLND     645
     PERLND     743
     PERLND     744
     RCHRES      71
     RCHRES      61
     RCHRES      52
     RCHRES      51
     RCHRES      41
     RCHRES      31
     RCHRES      21
     RCHRES      14
     RCHRES      13
     RCHRES      12
     RCHRES      11
     PLTGEN ***   1
   END INGRP
ND OPN SEQUENCE
**
EC-ACTIONS
 OPERATIONS         DATE AND TIME   TYPE  VARIAB  SUBSCR  AC  QUANTITY  ***
 TYPE    #   #                      CODE                                ***
   ***
   ***
   ******  1 9 8 9  SPECIAL ACTIONS  ******
   ***
   ***
****************   JANUARY    *******************
***
*** DECREASE INFILT DUE TO FROZEN GROUND
  PERLND116 744      1989/01/01          3  JGER           1   2.50
  PERLND116 744      1989/01/01          3  INFILT         1   .009
  PERLND116 744      1989/01/01          3  KGW            1   .014
  PERLND116 744      1989/01/17          3  INFILT         1   .010
  PERLND116 744      1989/01/20          3  TSNOW          1     34.0
  PERLND116 744      1989/01/20          3  DEEPFR         1    .05
  PERLND116 744      1989/01/27          3  INFILT         1   .005
***************     FEBRUARY    ******************
  PERLND116 744      1989/02/01          3  KGW            1   .010
  PERLND116 744      1989/02/07          3  LZSN           1     6.0
  PERLND116 744      1989/02/08          3  INFILT         1   .002
  PERLND116 744      1989/02/08          3  KGW            1   .0030
  PERLND116 744      1989/02/10          3  MGMELT         1  .0063
  PERLND116 744      1989/02/13          3  KGW            1   .0020
  PERLND116 744      1989/02/15          3  SNOWCF         1     7.4
  PERLND116 744      1989/02/16          3  MGMELT         1  .0002
  PERLND116 744      1989/02/16          3  KGW            1   .0012
  PERLND116 744      1989/02/17          3  INFILT         1   .001
  PERLND116 744      1989/02/20          3  TSNOW          1     34.0
  PERLND116 744      1989/02/20          3  COVIND         1    500.0
***************     MARCH        ******************
  PERLND116 744      1989/03/01          3  JGER           1   1.50
  PERLND116 744      1989/03/01          3  CCFACT         1     1.7
  PERLND116 744      1989/03/10          3  MGMELT         1  .0005
  PERLND116 744      1989/03/10          3  LZSN           1     4.0
  PERLND116 744      1989/03/10          3  KGW            1   .006
  PERLND116 744      1989/03/10          3  INFILT         1     .027
  PERLND116 744      1989/03/12          3  JRER           1   2.20
  PERLND116 744      1989/03/20          3  KGW            1   .008
  PERLND116 744      1989/03/24          3  LZSN           1     3.0
  PERLND116 744      1989/03/31          3  TSNOW          1     30.0
*********************    APRIL      ********************
***
   PERLND116 744      1989/04/02          3  LZSN           1     2.0
   PERLND116 744      1989/04/10          3  INFILT         1     .030
   PERLND116 744      1989/04/17          3  KGW            1   .0060
   PERLND116 744      1989/04/20          3  LZSN           1     3.5
   PERLND116 744      1989/04/27          3  KGW            1   .0040
   PERLND116 744      1989/04/27          3  INFILT         1     .040
*********************    MAY     ************************
   PERLND116 744      1989/05/01          3  DEEPFR         1    .05
   PERLND116 744      1989/05/01          3  LZSN           1     5.0
   PERLND116 744      1989/05/06          3  KGW            1   .0020
   PERLND116 744      1989/05/10          3  INFILT         1     .030
   PERLND116 744      1989/05/12          3  DEEPFR         1    .60
   PERLND116 744      1989/05/25          3  KGW            1    .010
   PERLND116 744      1989/05/25          3  INFILT         1   .010
 PERLND116 744      1989/05/30        3  INFILT          1   .035
 PERLND116 744      1989/05/30        3  KGW             1    .007
*********************** JUNE  ************************
 PERLND116 744      1989/06/02        3  LZSN            1    4.5
 PERLND116 744      1989/06/08        3  INFILT          1   .025
 PERLND116 744      1989/06/08        3  DEEPFR          1    .20
 PERLND116 744      1989/06/21        3  INFILT          1   .025
*********************** JULY  ************************
 PERLND116 744      1989/07/01        3  INFILT          1   .060
 PERLND116 744      1989/07/01        3  DEEPFR          1    .97
 PERLND116 744      1989/07/01        3  LZSN            1    6.0
*********************** AUGUST ************************
 PERLND116 744      1989/08/01        3  LZSN            1    8.0
*********************** SEPTEMBER ************************
 PERLND116 744      1989/09/01        3  LZSN            1    9.0
*********************** OCTOBER ************************
 PERLND116 744      1989/10/01        3  LZSN            1   10.0
***********************NOVEMBER***********************
 PERLND116 744      1989/11/01        3  DEEPFR          1    .99
 PERLND116 744      1989/11/01        3  LZSN            1    6.0
 PERLND116 744      1989/11/14        3  INFILT          1   .100
 PERLND116 744      1989/11/15        3  TSNOW           1     31.5
 PERLND116 744      1989/11/15        3  LZSN            1    6.0
 PERLND116 744      1989/11/15        3  KGW             1   .015
 PERLND116 744      1989/11/21        3  INFILT          1  .070
 PERLND116 744      1989/11/25        3  DEEPFR          1    .95
************************ DECEMBER ***************************
 PERLND116 744      1989/12/15        3  SNOWCF          1    4.0
 PERLND116 744      1989/12/20        3  MGMELT          1    .25
*  1990 SPECIAL ACTIONS   ***
************************JANUARY*****************************
 PERLND116 744      1990/01/01        3  KGER            1  0.007
 PERLND116 744      1990/01/01        3  KSER     ***    1  2.00
 PERLND116 744      1990/01/01        3  TSNOW           1    28.0
 PERLND116 744      1990/01/01        3  DEEPFR          1   .02
 PERLND116 744      1990/01/01        3  CCFACT          1  2.00
 PERLND116 744      1990/01/01        3  LZSN            1    3.0
 PERLND116 744      1990/01/01        3  INFILT          1  .0050
 PERLND116 744      1990/01/01        3  KGW             1   .005
 PERLND116 744      1990/01/10        3  SKMP            1   .001
 PERLND116 744      1990/01/10        3  UKMP            1   .001
 PERLND116 744      1990/01/10        3  LKMP            1   .001
 PERLND116 744      1990/01/10        3  AKMP            1   .001
**********************FEBRUARY*****************************
 PERLND116 744      1990/02/01        3  LZSN            1    2.0
 PERLND116 744      1990/02/21        3  KSER            1  0.10
 PERLND116 744      1990/02/21        3  KRER     ***    1  0.05
 PERLND116 744      1990/02/21        3  TSNOW           1    34.0
**********************MARCH*********************************
 PERLND116 744      1990/03/01        3  LZSN            1    2.0
**********************APRIL*********************************
 PERLND116 744      1990/04/01        3  SKMP            1 .0000
 PERLND116 744      1990/04/01        3  UKMP            1 .0000
 PERLND116 744      1990/04/01        3  LKMP            1 .0000
 PERLND116 744      1990/04/01        3  AKMP            1 .0000
 PERLND116 744      1990/04/01        3  INFILT          1  .030
 PERLND116 744      1990/04/01        3  LZSN            1    2.0
 PERLND116 744      1990/04/01        3  KGW             1   .0030
**********************MAY***********************************
 PERLND116 744      1990/05/01        3  DEEPFR          1   .80
 PERLND116 744      1990/05/01        3  LZSN            1    3.0
************************JUNE********************************
 PERLND116 744      1990/06/01        3  DEEPFR          1   .90
 PERLND116 744      1990/06/01        3  LZSN            1    6.0
 PERLND116 744      1990/06/25        3  INFILT          1  .070
************************JULY********************************
 PERLND116 744      1990/07/01        3  DEEPFR          1   .98
 PERLND116 744      1990/07/01        3  LZSN            1    5.0
*************************AUGUST*****************************
 PERLND116 744      1990/08/01        3  LZSN            1    6.0
**************************SEPTEMBER*************************
 PERLND116 744      1990/09/01        3  LZSN            1    6.0
**************************OCTOBER***************************
 PERLND116 744      1990/10/01        3  DEEPFR          1   .40
 PERLND116 744      1990/10/01        3  LZSN            1    5.0
 PERLND116 744      1990/10/01        3  INFILT          1  .020
**************************NOVEMBER**************************
 PERLND116 744      1990/11/01        3  KGER            1  0.050
 PERLND116 744      1990/11/01        3  LZSN            1    4.0
 PERLND116 744      1990/11/15        3  INFILT          1  .030
 PERLND116 744      1990/11/15        3  KGW             1   .010
**************************DECEMBER**************************
 PERLND116 744      1990/12/01        3  CMAXP           1   .000
 PERLND116 744      1990/12/01        3  LZSN            1    3.0
 PERLND116 744      1990/12/01        3  DEEPFR          1   .05
ND SPEC-ACTIONS
**
ERLND
  ACTIVITY
  < RANGE> ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  ***
  116  744          1    1    1    1             1              1
  116  744  ***     1    1    1
  116  744  ***     1    1
  END ACTIVITY
  PRINT-INFO
** 2-EACH PIVL,3-DAILY,4-MONTHLY,5-ANNUALLY,6-NEVER  ***
  < RANGE> ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC PIVL***YR
  116               6    6    4    6    6         6              4             12
  121               6    6    5    6    6         6              5             12
  122  744          6    6    6    6    6         6              6             12
  614       ***     6    3    6    6    3         3              3             12
  623  744  ***     6    6    6    6    6         6              6             12
  END PRINT-INFO
  GEN-INFO
  < RANGE><-PLS-ID (20 CHAR)-> NBLK   UU   IU   OU ENGL METR  ***
  116      1 %-HNYWD-CONV W/GR    1    2    2    2         6
  121      1 %-TSCLA-BUILDINGS    1    2    2    2         6
  122      1 %-TSCLA-IDLE/PAST    1    2    2    2         6
  123      1 %-TSCLA-CONV CORN    1    2    2    2         6
  124      1 %-TSCLA-REDCD CORN   1    2    2    2         6
  126      1 %-TSCLA-CONV W/GR    1    2    2    2         6
  129      1 %-TSCLA-CONV BEAN    1    2    2    2         6
  131      1 %-CRMBE-REDCD BEAN   1    2    2    2         6
  133      1 %-CRMBE-CONV CORN    1    2    2    2         6
  140      1 %-EMBRO-REDCD BEAN   1    2    2    2         6
  141      1 %-EMBRO-BUILDINGS    1    2    2    2         6
  142      1 %-EMBRO-IDLE/PAST    1    2    2    2         6
  143      1 %-EMBRO-CONV CORN    1    2    2    2         6
  144      1 %-EMBRO-REDCD CORN   1    2    2    2         6
  146      1 %-EMBRO-CONV W/GR    1    2    2    2         6
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149      1 %-EMBRO-CONV BEAN     1    2    2    2         6
213      3 %-HNYWD-CONV CORN     1    2    2    2         6
224      3 %-TSCLA-REDCD CORN    1    2    2    2         6
226      3 %-TSCLA-CONV W/GR     1    2    2    2         6
233      3 %-CRMBE-CONV CORN     1    2    2    2         6
241      3 %-EMBRO-BUILDINGS     1    2    2    2         6
243      3 %-EMBRO-CONV CORN     1    2    2    2         6
244      3 %-EMBRO-REDCD CORN    1    2    2    2         6
249      3 %-EMBRO-CONV BEAN     1    2    2    2         6
614      1 %-HNYWD-CONV SP/GR    1    2    2    2         6
623      1 %-TSCLA-WOODLOT       1    2    2    2         6
624      1 %-TSCLA-CONV SP/GR    1    2    2    2         6
625      1 %-TSCLA-RED SP/GR     1    2    2    2         6
643      1 %-EMBRO-WOODLOT       1    2    2    2         6
644      1 %-EMBRO-CONV S/GR     1    2    2    2         6
645      1 %-EMBRO-RED SP/GR     1    2    2    2         6
743      3 %-EMBRO-WOODLOT       1    2    2    2         6
744      3 %-EMBRO-CONV SP/GR    1    2    2    2         6
 END GEN-INFO
***
*   START SNOW BLOCK  ***
 ICE-FLAG
   <PLS > ICE- ***
   # -  # FLAG ***
 111  973    0
 END ICE-FLAG
 SNOW-PARM1
   <PLS >  LATITUDE     MEAN-     SHADE    SNOWCF    COVIND***
   #    #               ELEV                              ***
*  BUILDINGS/HOMESTEADS
 121           43.15     275      0.80       1.0       50.
 131           43.15     275      0.80       1.0       50.
 141           43.15     275      0.80       1.0       50.
 241           43.15     275      0.80       1.0       50.
*  WOODLOTS
 623           43.15     275      0.80       1.0       50.
 643           43.15     275      0.80       1.0       50.
 743           43.15     275      0.80       1.0       50.
***  ALL OTHER PLS'S
 116           43.15     275      0.90       1.0       70.
 122  129      43.15     275      0.90       1.0       70.
 133  140      43.15     275      0.90       1.0       70.
 142  233      43.15     275      0.90       1.0       70.
 243  614      43.15     275      0.90       1.0       70.
 624  625      43.15     275      0.90       1.0       70.
 644  645      43.15     275      0.90       1.0       70.
 744           43.15     275      0.90       1.0       70.
 END SNOW-PARM1
 SNOW-PARM2
   <PLS >***
   # -  #       RDCSN     TSNOW    SNOEVP    CCFACT    MWATER    MGMELT***
 116  744       0.15       0.0     0.20       0.70      .250      0.20
 END SNOW-PARM2
 SNOW-INIT1
   <PLS >***
   # -  # PACK-SNOW  PACK-ICE PACK-WATR    RDENPF      DULL    PAKTMP***
 116  614      34.0        0.       8.5       0.2      500.      0.0
 624           34.0        0.       8.5       0.2      500.      0.0
 625           34.0        0.       8.5       0.2      500.      0.0
 644           34.0        0.       8.5       0.2      500.      0.0
 645           34.0        0.       8.5       0.2      500.      0.0
 744           34.0        0.       8.5       0.2      500.      0.0
*** Woodlots start with more snow pack    ***
 623           36.0        0.        9.       0.2      500.      0.0
 643           36.0        0.        9.       0.2      500.      0.0
 743           36.0        0.        9.       0.2      500.      0.0
 END SNOW-INIT1
 SNOW-INIT2
   <PLS >***
   # -  #     COVINX    XLNMLT    SKYCLR***
 116  744       50.       0.5
 END SNOW-INIT2
**
**  START PWATER BLOCK   ***
 PWAT-PARM1
**  INTERCEPTION VARIES FOR ALL PLS'S---UPPER ZONE STORAGE AND MANNINGS
**  N VARY FOR TILLED FIELDS AND E-T VARIES FOR ALL PLS'S
 < RANGE> CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE  ***
 116         1    1    1    1    1    1    1    1    0
 121         1    1    1    1    0    0    1    0    0
 122         1    1    1    1    1    1    1    1    0
 123         1    1    1    1    1    1    1    1    0
 124         1    1    1    1    1    1    1    1    0
 126         1    1    1    1    1    1    1    1    0
 129         1    1    1    1    1    1    1    1    0
 131         1    1    1    1    0    0    1    0    0
 133         1    1    1    1    1    1    1    1    0
 140         1    1    1    1    1    1    1    1    0
 141         1    1    1    1    0    0    1    0    0
 142         1    1    1    1    1    1    1    1    0
 143         1    1    1    1    1    1    1    1    0
 144         1    1    1    1    1    1    1    1    0
 146         1    1    1    1    1    1    1    1    0
 149         1    1    1    1    1    1    1    1    0
 213         1    1    1    1    1    1    1    1    0
 224         1    1    1    1    1    1    1    1    0
 226         1    1    1    1    1    1    1    1    0
 233         1    1    1    1    1    1    1    1    0
 241         1    1    1    1    0    0    1    0    0
 243         1    1    1    1    1    1    1    1    0
 244         1    1    1    1    1    1    1    1    0
 249         1    1    1    1    1    1    1    1    0
 614         1    1    1    1    1    1    1    1    0
 623         1    1    1    1    0    0    1    0    1
 624         1    1    1    1    1    1    1    1    0
 625         1    1    1    1    1    1    1    1    0
 643         1    1    1    1    0    0    1    0    1
 644         1    1    1    1    1    1    1    1    0
 645         1    1    1    1    1    1    1    1    0
 743         1    1    1    1    0    0    1    0    1
 744         1    1    1    1    1    1    1    1    0
 END PWAT-PARM1
 PWAT-PARM2
 < RANGE><-FOREST-><--LZSN--><-INFILT-><--LSUR--><--SLSUR-><--KVARY-><***AGWRC>
***    1% SLOPE  ***
***  HONEYWOOD SERIES ***
  116          0.10      100.       2.0      120.0    0.01                 0.85
  614          0.05      100.       2.0      120.0    0.01                 0.85
***   TUSCOLA SERIES ***
  121          0.10      100.       2.0      120.0    0.01                 0.85
 122          0.05       100.      2.0       120.0    0.01              0.85
 123          0.05       100.      2.0       120.0    0.01              0.85
 124          0.05       100.      2.0       120.0    0.01              0.85
 126          0.05       100.      2.0       120.0    0.01              0.85
 129          0.05       100.      2.0       120.0    0.01              0.85
 623          1.00       100.      2.0       120.0    0.01              0.85
 624          0.05       100.      2.0       120.0    0.01              0.85
 625          0.05       100.      2.0       120.0    0.01              0.85
*  CROMBIE SERIES ***
 131          0.10       100.      0.8       120.0    0.01              0.85
 133          0.05       100.      0.8       120.0    0.01              0.85
***  EMBRO SERIES  ***
 140          0.05       100.      2.0       120.0    0.01              0.85
 141          0.10       100.      2.0       120.0    0.01              0.85
 142          0.05       100.      2.0       120.0    0.01              0.85
 143          0.05       100.      2.0       120.0    0.01              0.85
 144          0.05       100.      2.0       120.0    0.01              0.85
 146          0.05       100.      2.0       120.0    0.01              0.85
 149          0.05       100.      2.0       120.0    0.01              0.85
 643          1.00       100.      2.0       120.0    0.01              0.85
 644          0.05       100.      2.0       120.0    0.01              0.85
 645          0.05       100.      2.0       120.0    0.01              0.85
*  3% SLOPES
*  HONEYWOOD SERIES ***
 213          0.05       100.      2.0       100.0    0.03              0.85
***   TUSCOLA SERIES ***
 224          0.05       100.      2.0       100.0    0.03              0.85
 226          0.05       100.      2.0       100.0    0.03              0.85
*  CROMBIE SERIES ***
 233          0.05       100.      0.8       100.0    0.03              0.85
*  EMBRO SERIES ***
 241          0.10       100.      2.0       100.0    0.03              0.85
 243          0.05       100.      2.0       100.0    0.03              0.85
 244          0.05       100.      2.0       100.0    0.03              0.85
 249          0.05       100.      2.0       100.0    0.03              0.85
 743          1.00       100.      2.0       100.0    0.03              0.85
 744          0.05       100.      2.0       100.0    0.03              0.85
 END PWAT-PARM2
 PWAT-PARM3
 < RANGE><PETMAX   ><PETMIN   ><INFEXP   ><INFLD***><DEEPFR   ><BASETP   ><AGWETP   >
 116  614  4.5         1.7          2.0        2.0          0.05      0.00      0.00
 614                                2.0        2.0          0.05      0.00      0.00
 624                                2.0        2.0          0.05      0.00      0.00
 625                                2.0        2.0          0.05      0.00      0.00
 644                                2.0        2.0          0.05      0.00      0.00
 645                                2.0        2.0          0.05      0.00      0.00
 744                                2.0        2.0          0.05      0.00      0.00
 *** Woodlots contribute to groundwater ET ***
 623                                2.0        2.0          0.05      0.10      0.0
 643                                2.0        2.0          0.05      0.10      0.0
 743                                2.0        2.0          0.05      0.10      0.0
 END PWAT-PARM3
 PWAT-PARM4
 < RANGE><--CEPSC-><--UZSN--><--NSUR--><--INTFW-><---IRC--><--LZETP->  ***
 116  744                13.0     0.30          0.0      0.50      0.10
 END PWAT-PARM4
 MON-INTERCEP
   <PLS >  INTERCEPTION STORAGE CAPACITY AT START OF EACH MONTH***
   # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
***  CONVENTIONALLY TILLED AREAS  ***
 116          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 123          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 126          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 129          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 133          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 143          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 146          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 149          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 213          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 226          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 233          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 243          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 249          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 614          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  3.0  2.0  0.0
 624          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 644          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
 744          0.0  0.0  0.0  1.5  5.0  3.0  3.0  3.0  3.0  5.0  2.0  0.0
***   CONSERVATION TILLED AREAS  ***
 121          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 122          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 124          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 131          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 140          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 141          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 142          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 144          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 224          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 241          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 244          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 625          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 645          0.0  0.0  0.0  1.0  1.5  2.0  2.5  2.5  2.5  2.5  2.0  0.0
 *** Woodlots provide interception throughout the year
 623          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 643          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 743          2.0  2.0  2.0  2.0  3.0  4.5  4.5  4.5  4.5  4.5  3.5  2.0
 END MON-INTERCEP
 MON-UZSN
   <PLS >  MONTHLY UPPER ZONE STORAGE FOR ALL TILLED FIELDS ***
   # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
**   PASTURE   ****
 122          12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.
 142          12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.  12.
***  CONVENTIONAL CORN  ***
 123           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 133           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 143           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 213           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 233           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
 243           2.   2.   2.  12.  10.  11.  11.  10.  10.  10.  15.   7.
***   REDUCED TILL CORN  ***
 124           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 144           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 224           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
 244           2.   2.   2.  11.  10.  10.  10.  10.  10.  10.  10.   7.
**   NO TILL CORN  ***
***  CONVENTIONAL WINTER GRAIN   ***
 116           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 126           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 146           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 226           2.   2.   2.  10.  10.  10.  12.  12.  12.  12.  10.   7.
 ***  REDUCED TILL  WINTER GRAIN  ***
  *    NO TILL WINTER GRAIN  ***
  *    CONVENTIONAL TILL BEANS  ***
  129         2.   2.   2.  12.  10.  10.  12.  10.  15.  12.  10.   7.
  149         2.   2.   2.  12.  10.  10.  12.  10.  15.  12.  10.   7.
  249         2.   2.   2.  12.  10.  10.  12.  10.  15.  12.  10.   7.
 ***   REDUCED TILL BEANS  ***
  140         2.   2.   2.  10.  10.  10.   9.   8.  10.   8.   6.   5.
  *    NO TILL BEANS   ***
  *    FALLOW  ***
  ** CONVENTIONAL SPRING GRAIN  ***
  614         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  624         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  644         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  744         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  * NO TILL SPRING GRAIN  ***
  625         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  645         2.   2.   2.  10.  10.  10.  12.  12.  12.  10.   8.   6.
  END MON-UZSN
  MON-MANNING
    <PLS >  MANNING'S N AT START OF EACH MONTH FOR ALL TILLED FIELDS ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
 **   PASTURE    ****
  132       0.20 0.20 0.20 0.20 0.25 0.25 0.25 0.25 0.25 0.25 0.20 0.20
  142       0.20 0.20 0.20 0.20 0.25 0.25 0.25 0.25 0.25 0.25 0.20 0.20
 ***  CONVENTIONAL CORN  ***
  123       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
  133       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
  143       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
  213       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
  233       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
  243       .050 .050 .050 .050 .100 .080 .075 .075 .075 .075 .080 .100
 ***   REDUCED TILL CORN  ***
  124       .075 .075 .075 .075 .080 .085 .085 .085 .090 .090 .090 .075
  144       .075 .075 .075 .075 .080 .085 .085 .085 .090 .090 .090 .075
  224       .075 .075 .075 .075 .080 .085 .085 .085 .090 .090 .090 .075
  244       .075 .075 .075 .075 .080 .085 .085 .085 .090 .090 .090 .075
 **    NO TILL CORN  ***
 ***  CONVENTIONAL WINTER GRAIN  ***
  116       0.10 0.10 0.10 0.15 0.20 0.20 0.25 0.25 0.15 0.10 0.10 0.10
  126       0.10 0.10 0.10 0.15 0.20 0.20 0.25 0.25 0.15 0.10 0.10 0.10
  146       0.10 0.10 0.10 0.15 0.20 0.20 0.25 0.25 0.15 0.10 0.10 0.10
  226       0.10 0.10 0.10 0.15 0.20 0.20 0.25 0.25 0.15 0.10 0.10 0.10
 **  REDUCED TILL  WINTER GRAIN  ***
 ***   NO TILL WINTER GRAIN  ***
 ***   CONVENTIONAL TILL BEANS  ***
  129       0.05 0.05 0.05 0.10 0.09 0.09 0.09 0.09 0.10 0.10 0.09 0.05
  149       0.05 0.05 0.05 0.10 0.09 0.09 0.09 0.09 0.10 0.10 0.09 0.05
  249       0.05 0.05 0.05 0.10 0.09 0.09 0.09 0.09 0.10 0.10 0.09 0.05
 **    REDUCED TILL BEANS  ***
  140       .075 .075 .075 .075 .080 .085 .085 .085 .090 .090 .090 .075
 ***   NO TILL BEANS   ***
 ***   FALLOW  ***
  ** CONVENTIONAL SPRING GRAIN  ***
  614       0.05 0.05 0.05 0.10 0.15 0.20 0.25 0.25 0.15 0.10 0.05 0.05
  624       0.05 0.05 0.05 0.10 0.15 0.20 0.25 0.25 0.15 0.10 0.05 0.05
  644       0.05 0.05 0.05 0.10 0.15 0.20 0.25 0.25 0.15 0.10 0.05 0.05
  744       0.05 0.05 0.05 0.10 0.15 0.20 0.25 0.25 0.15 0.10 0.05 0.05
 *** NO TILL SPRING GRAIN  ***
  625       0.05 0.05 0.05 0.05 0.10 0.20 0.25 0.25 0.15 0.10 0.05 0.05
  645       0.05 0.05 0.05 0.05 0.10 0.20 0.25 0.25 0.15 0.10 0.05 0.05
  END MON-MANNING
  MON-INTERFLW
    <PLS >  Interflow Inflow Parameter for Start of Each Month ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  116  744 2.00 1.50 0.70 0.60 1.00 0.00 0.00 0.00 0.00 0.00 1.50 1.50
  END MON-INTERFLW
  MON-IRC
    <PLS >  INTERFLOW RECESSION CONSTANT ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  116  744  .50  .50  .85  .90  .60  .60  .60  .60  .50  .60  .80  .60
  END MON-IRC
  MON-LZETPARM
    <PLS >  LOWER ZONE E-T PARAMETER FOR WOODLOTS ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  116  614  .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
  624       .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
  625       .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
  644       .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
  645       .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
  744       .05  .05  .05  .05  .20  .40  .50  .70  .70  .60  .20  .10
 **  WOODLOTS HAVE HIGHER LOWER ZONE E-T   ***
  623       0.1  0.1  .05  .30  0.5  0.6  0.7  0.7  0.7  0.5  0.2  0.1
  643       0.1  0.1  .05  .30  0.5  0.6  0.7  0.7  0.7  0.5  0.2  0.1
  743       0.1  0.1  .05  .30  0.5  0.6  0.7  0.7  0.7  0.5  0.2  0.1
  END MON-LZETPARM
  PWAT-STATE1
    <PLS >***
    # -  ****    CEPS        SURS        UZS        IFWS        LZS        AGWS        GWVS
  116  744       0.0         0.0        11.0        0.3        90.0         0.0         0.0
  END PWAT-STATE1
 ***  START SEDMNT BLOCK  ***
  SED-PARM1
    <PLS > ***
    # -  #  CRV VSIV SDOP ***
 **  BUILDINGS/HOMESTEADS
  121           0    0    0
  131           0    0    0
  141           0    0    0
  241           0    0    0
 **  WOODLOTS
  623           1    0    0
  643           1    0    0
  743           1    0    0
 ***  ALL OTHER PLS'S
  116           1    0    0
  122  129      1    0    0
  133  140      1    0    0
  142  233      1    0    0
  243  614      1    0    0
  624  625      1    0    0
  644  645      1    0    0
  744           1    0    0
  END SED-PARM1
  SED-PARM2
    <PLS > ***  INTERRILL PARAMETERS BY SOIL TYPE
    # -  # ***  SMPF       KRER       JRER       AFFIX       COVER       NVSI
 ***  HONEYWOOD SERIES
  116  774          1.0        0.40        2.2        0.90        0.99
  116               1.0        0.40 ***    2.2        0.90        0.99
 213            1.0     0.40 ***   2.2      0.90      0.99
 614            1.0     0.40 ***   2.2      0.90      0.99
*  TUSCOLA SERIES ***
 121  129       1.0     0.49 ***   2.2      0.90      0.99
 224  226       1.0     0.49 ***   2.2      0.90      0.99
 623  625       1.0     0.49 ***   2.2      0.90      0.99
***   CROMBIE     ***
 131  133       1.0     0.43 ***   2.2      0.90      0.99
 233            1.0     0.43 ***   2.2      0.90      0.99
*  EMBRO ***
 140  149       1.0     0.44***    2.2      0.90      0.99
 241  249       1.0     0.44 ***   2.2      0.90      0.99
 643  645       1.0     0.44 ***   2.2      0.90      0.99
 743  744       1.0     0.44 ***   2.2      0.90      0.99
 END SED-PARM2
 SED-PARM3
   <PLS > ***  WASHOFF-DELIVERY AND RILL (GULLY) EROSION BY RESIDUE LEVELS
   # -  # ***  KSER      JSER      KGER      JGER
***   CONVENTIONALLY TILLED AREAS  ***
 116            5.0       2.7     .2500      1.50
 123            5.0       2.7     .2500      1.50
 126            5.0       2.7     .2500      1.50
 129            5.0       2.7     .2500      1.50
 133            5.0       2.7     .2500      1.50
 143            5.0       2.7     .2500      1.50
 146            5.0       2.7     .2500      1.50
 149            5.0       2.7     .2500      1.50
 213            5.0       2.7     .2500      1.50
 226            5.0       2.7     .2500      1.50
 233            5.0       2.7     .2500      1.50
 243            5.0       2.7     .2500      1.50
 249            5.0       2.7     .2500      1.50
 614            5.0       2.7     .2500      1.50
 624            5.0       2.7     .2500      1.50
 644            5.0       2.7     .2500      1.50
 744            5.0       2.7     .2500      1.50
**    CONSERVATION TILLED AREAS  ***
 121            3.0       2.7     .1500      1.50
 122            3.0       2.7     .1500      1.50
 124            3.0       2.7     .1500      1.50
 131            3.0       2.7     .1500      1.50
 140            3.0       2.7     .1500      1.50
 141            3.0       2.7     .1500      1.50
 142            3.0       2.7     .1500      1.50
 144            3.0       2.7     .1500      1.50
 224            3.0       2.7     .1500      1.50
 241            3.0       2.7     .1500      1.50
 244            3.0       2.7     .1500      1.50
 623            3.0       2.7     .1500      1.50
 625            3.0       2.7     .1500      1.50
 643            3.0       2.7     .1500      1.50
 645            3.0       2.7     .1500      1.50
 743            3.0       2.7     .1500      1.50
 END SED-PARM3
 MON-COVER
   <PLS >  MONTHL/ VALUES FOR EROSION RELATED LAND COVER BY LAND USE  ***
   # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
***   PASTURE    ****
 116  744  .30  .30  .30  .50  .60  .90 1.00 1.00  .90  .80  .60  .30
 122 ***   .95  .95  .95  .95  .95  .95 0.95  .95  .95  .95  .95  .95
 142 ***   .95  .95  .95  .95  .95  .95  .95  .95  .95  .95  .95  .95
**  CONVENTIONAL CORN  ***
 123 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
 133 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
 143 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
 213 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
 233 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
 243 ***  0.05 0.05 0.05 0.05 0.10 0.50 0.60 0.70 0.80 0.80 0.80 0.05
**    REDUCED TILL CORN  ***
 124 ***  0.30 0.30 0.30 0.30 0.35 0.70 0.80 0.90 0.90 0.90 0.90 0.30
 144 ***  0.30 0.30 0.30 0.30 0.35 0.70 0.80 0.90 0.90 0.90 0.90 0.30
 224 ***  0.30 0.30 0.30 0.30 0.35 0.70 0.80 0.90 0.90 0.90 0.90 0.30
 244 ***  0.30 0.30 0.30 0.30 0.35 0.70 0.80 0.90 0.90 0.90 0.90 0.30
**    NO TILL CORN  ***
**  CONVENTIONAL WINTER GRAIN  ***
 116 ***  0.20 0.20 0.30 0.50 0.60 0.95 0.95 0.95 0.05 0.15 0.20 0.20
 126 ***  0.20 0.20 0.30 0.50 0.60 0.95 0.95 0.95 0.05 0.15 0.20 0.20
 146 ***  0.20 0.20 0.30 0.50 0.60 0.95 0.95 0.95 0.05 0.15 0.20 0.20
 226 ***  0.20 0.20 0.30 0.50 0.60 0.95 0.95 0.95 0.05 0.15 0.20 0.20
**  REDUCED TILL  WINTER GRAIN  ***
**    NO TILL WINTER GRAIN  ***
**    CONVENTIONAL TILL BEANS  ***
 129 ***  0.05 0.05 0.05 0.05 0.10 0.60 0.80 0.80 0.80 0.05 0.05 0.05
 149 ***  0.05 0.05 0.05 0.05 0.10 0.60 0.80 0.80 0.80 0.05 0.05 0.05
 249 ***  0.05 0.05 0.05 0.05 0.10 0.60 0.80 0.80 0.80 0.05 0.05 0.05
***   REDUCED TILL BEANS  ***
 140 ***  0.20 0.20 0.20 0.20 0.25 0.70 0.90 0.90 0.90 0.20 0.20 0.20
**    NO TILL BEANS    ***
**    FALLOW  ***
**    WOODLOTS
 623 ***  0.70 0.70 0.70 0.80 0.95 0.95 0.95 0.95 0.95 0.90 0.70 0.70
 643 ***  0.70 0.70 0.70 0.80 0.95 0.95 0.95 0.95 0.95 0.90 0.70 0.70
 743 ***  0.70 0.70 0.70 0.80 0.95 0.95 0.95 0.95 0.95 0.90 0.70 0.70
** CONVENTIONAL SPRING GRAIN  ***
 614 ***  0.05 0.05 0.05 0.30 0.60 0.95 0.95 0.95 0.05 0.05 0.05 0.05
 624 ***  0.05 0.05 0.05 0.30 0.60 0.95 0.95 0.95 0.05 0.05 0.05 0.05
 644 ***  0.05 0.05 0.05 0.30 0.60 0.95 0.95 0.95 0.05 0.05 0.05 0.05
 744 ***  0.05 0.05 0.05 0.30 0.60 0.95 0.95 0.95 0.05 0.05 0.05 0.05
*** NO TILL SPRING GRAIN  ***
 625 ***  0.25 0.25 0.25 0.30 0.60 0.95 0.95 0.95 0.25 0.25 0.25 0.25
 645 ***  0.25 0.25 0.25 0.30 0.60 0.95 0.95 0.95 0.25 0.25 0.25 0.25
 END MON-COVER
 SED-STOR
   <PLS > *** DETACHED SEDIMENT STORAGE (TONNES/HA)
   # -  # ***BLOCK1    BLOCK2    BLOCK3    BLOCK4
 116  744     0.000
 END SED-STOR
                                                                      ***
 *** SECTION PSTEMP ***
 PSTEMP-PARM1
   # -  # SLTV ULTV LGTV TSOP ***
 116  744    0    0    1    1
 END PSTEMP-PARM1
 PSTEMP-PARM2
   # -  #       ASLT      BSLT     ULTP1     ULTP2     LGTP1     LGTP2 ***
 116  744         0.        .9       2.0       0.8       0.1       0.0
 END PSTEMP-PARM2
 MON-LGTP1
   <PLS > MONTHLY VALUES FOR LOWER/GROUNDWATER TEMPERATURES (F)   ***
   #    #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
```

```
116  744  30.  30.  32.  45.  50.  50.  55.  55.  50.  45.  33.  30.
END MON-LGTP1
PSTEMP-TEMPS
  # - #       AIRTC      SLTMP      ULTMP      LGTMP ***
116  744        1.0        0.0       -1.0       -0.5
END PSTEMP-TEMPS
*** SECTION MSTLAY ***
MST-PARM
  <PLS >      SLMPF       ULPF       LLPF  ***
  # - #                                    ***
116  744        0.3        3.0        3.0
END MST-PARM
***
SOIL-DATA
  <PLS >  SOIL LAYER DEPTHS AND BULK DENSITIES                          ***
  # - #               DEPTHS (CM)                 BULK DENSITY (GM/CC)      ***
          SURFACE    UPPER   LOWER GROUNDW SURFACE   UPPER   LOWER GROUNDW ***
116  744    0.40      6.0    50.0     0.1     1.5     1.52    1.53    1.55
END SOIL-DATA
***
*** SECTION PHOS ***
PHOS-FLAGS
  # - # VPUT FORP ITMX BNUM CNUM ***
116  744    1    1   50    4    4
END PHOS-FLAGS
MON-PHOSUPT
  <PLS > Monthly Phosphorus Uptake for Surface Layer (/day)             ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC     ***
**  BUILDINGS/HOMESTEADS
 121       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 131       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 141       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 241       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
**  WOODLOTS
 623       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 643       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 743       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
***  ALL OTHER PLS'S
 116       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 122  129  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 133  140  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 142  233  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 243  614  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 624  625  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 644  645  .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 744       .00  .00  .00 .005 .005 .010 .010 .010 .010 .005 .001  .00
 END MON-PHOSUPT
 MON-PHOSUPT
  <PLS > Monthly Phosphorus Uptake for Upper Layer (/day)               ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC     ***
**  BUILDINGS/HOMESTEADS
 121       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 131       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 141       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 241       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
**  WOODLOTS
 623       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
 643       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
 743       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
***  ALL OTHER PLS'S
 116       .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 122  129  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 133  140  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 142  233  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 243  614  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 624  625  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 644  645  .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 744       .00  .00  .00 0.50 1.00 1.50 2.00 2.00 1.50 1.00 0.50  .00
 END MON-PHOSUPT
 MON-PHOSUPT
  <PLS > Monthly Phosphorus Uptake for Lower Layer (/day)               ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC     ***
***  BUILDINGS/HOMESTEADS
 121       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 131       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 141       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
 241       .00  .00  .00 .010 .020 .050 .050 .050 .030 .020 .010  .00
***  WOODLOTS
 623       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
 643       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
 743       .00  .00  .00 .100 .200 .500 .500 .500 .300 .200 .100  .00
**  ALL OTHER PLS'S
 116       .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 122  129  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 133  140  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 142  233  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 243  614  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 624  625  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 644  645  .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 744       .00  .00  .00 0.50 0.70 1.00 1.00 1.00 0.70 0.50 0.30  .00
 END MON-PHOSUPT
 MON-PHOSUPT
  <PLS > Monthly Phosphorus Uptake for Groundwater (/day)               ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC     ***
**  ALL PLS'S
 116  744  .00  .00  .00  .00  .00  .00  .00  .00  .00  .00  .00  .00
 END MON-PHOSUPT
 PHOS-FSTGEN
  # - #       THPLP     THKDSP     THKADP     THKIMP      THKMP ***
 116  744                 1.10       1.10
 END PHOS-FSTGEN
 PHOS-FSTPM
  <PLS > Phosphorus first-order parameters for surface layer (/day)       ***
  # - #        KDSP       KADP       KIMP        KMP                       ***
 116  744                           0.010      .0010
 END PHOS-FSTPM
 PHOS-FSTPM
  <PLS > Phosphorus first-order parameters for upper layer (/day)         ***
  # - #        KDSP       KADP       KIMP        KMP                       ***
 116  744                           0.010       .005
 END PHOS-FSTPM
 PHOS-FSTPM
  <PLS > Phosphorus first-order parameters for lower layer (/day)         ***
  # - #        KDSP       KADP       KIMP        KMP                       ***
 116  744                           0.010       .001
 END PHOS-FSTPM
 PHOS-FSTPM
  <PLS > Phosphorus first-order parameters for ground water layer (/day) ***
  # - #        KDSP       KADP       KIMP        KMP                       ***
 116  744                           0.010       .001
```

```
  END PHOS-FSTPM
  PHOS-CMAX
    <PLS > Maximum Solubility of Phosphate (mg/l)                        ***
    #    #       CMAX                                                    ***
  116  744       0.17
  END PHOS-CMAX
  PHOS-SVALPM
    <PLS > Freundlich adsorption/desorption parameters (surface layer)   ***
    #    #       XFIX        K1         N1                               ***
  116  744      2200.       15.0        1.5
  END PHOS-SVALPM
  PHOS-SVALPM
    <PLS > Freundlich adsorption/desorption parameters (upper layer)     ***
    #    #       XFIX        K1         N1                               ***
  116  744      500.0       15.0        1.5
  END PHOS-SVALPM
  PHOS-SVALPM
    <PLS > Freundlich adsorption/desorption parameters (lower layer)     ***
    #    #       XFIX        K1         N1                               ***
  116  744      438.0       15.0        1.5
  END PHOS-SVALPM
  PHOS-SVALPM
    <PLS > Freundlich adsorption/desorption parameters (groundwater layer) ***
    #    #       XFIX        K1         N1                               ***
  116  744      444.5       15.0        1.5
  END PHOS-SVALPM
  PHOS-STOR1
    <PLS > Initial phosphorus in surface layer, block 1 (kg/ha)          ***
    # -  #       ORGP       P4AD       P4SU       PLTP                   ***
  116  744      84.00     134.00        0.0        0.2
  END PHOS-STOR1
  PHOS-STOR1
    <PLS > initial phosphorus in upper layer, block 1 (kg/ha)            ***
    # -  #       ORGP       P4AD       P4SU       PLTP                   ***
  116  744      250.0       494.        0.0        4.0
  END PHOS-STOR1
  PHOS-STOR1
    <PLS > initial phosphorus in lower layer, block 1 (kg/ha)            ***
    # -  #       ORGP       P4AD       P4SU       PLTP                   ***
  116  744       306.      3500.        0.0         5.
  END PHOS-STOR1
  PHOS-STOR1
    <PLS > initial phosphorus in groundwater layer, block 1 (kg/ha)      ***
    # -  #       ORGP       P4AD       P4SU       PLTP                   ***
  116  744       .612       7.00       0.00         0.
  END PHOS-STOR1
  PHOS-STOR2
    <PLS > phosphate in interflow in block 1  (kg/ha)                    ***
    # -  #      IP4SU                                                    ***
  116  744      .0000
  END PHOS-STOR2
END PERLND
***
RCHRES
  ACTIVITY
  < RANGE> HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG  ***
   11***71    1
   11***71    1    1              1
   11   71    1    1    1         1
  END ACTIVITY
  PRINT-INFO
  < RANGE> HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  ***
   11   71    6    6    4         6            ***                   12
   11         6    6    4         4                                  12
   12   71    6    6    6         6                                  12
  END PRINT-INFO
  GEN-INFO
  < RANGE><-RCH-ID (20 CHAR)->  NEX   UU   IU   OU ENGL METR LKFG  ***
   11      LOWER GORING DRAIN     1    2    2    2         6
   12      MIDDLE GORING DRAIN    1    2    2    2         6
   13      UPPER GORING DRAIN     1    2    2    2         6
   14      PTB2 MICROBASIN        1    2    2    2         6
   21      SOUTHWEST BRANCH       1    2    2    2         6
   31      PTB1 MICROBASIN        1    2    2    2         6
   41      WALKER'S SLOUGH        1    2    2    2         6
   51      NORTH BRANCH           1    2    2    2         6
   52      NORTH CTL HEADWATER    1    2    2    2         6
   61      CENTRAL BRANCH         1    2    2    2         6
   71      NORTHWEST HEADWATER    1    2    2    2         6
  END GEN-INFO
  HYDR-PARM1
  < RANGE>  VC A1 A2 A3   V1 V2 V3 V4 V5      T1 T2 T3 T4 T5  *** F1 F2 F3 F4 F5
   11   71      1  1  1    4                   0                   3
  END HYDR-PARM1
  HYDR-PARM2
  < RANGE><-FTABNO-><---LEN--><--DELTH-><--STCOR-><---KS---><--DB50-->  ***
   11            110     0.420    4.00        350.0       0.5      0.10
   12            120     1.050    9.00        350.0       0.5      0.10
   13            130     1.570    7.50        350.0       0.5      0.10
   14            140     0.550    3.50        350.0       0.5      0.10
   21            210     1.240    9.05        350.0       0.5      0.10
   31            310     0.630    7.60        350.0       0.5      0.10
   41            410     1.460    9.90        350.0       0.5      0.10
   51            510     0.650    6.50        350.0       0.5      0.10
   52            520     0.980    7.55        350.0       0.5      0.10
   61            610     0.730    5.00        350.0       0.5      0.10
   71            710     0.400    1.50        350.0       0.5      0.10
  END HYDR-PARM2
  HYDR-INIT
  < RANGE><---VOL--->--5X-<-----COLIND(5F5.0)----->--5X-<----OUTDGT(5F5.0)---***>
   11        0.00004       4.3
   12        0.00007       4.3
   13        0.00009       4.3
   14        0.00008       4.3
   21        0.00006       4.3
   31        0.00009       4.3
   41        0.00015       4.3
   51        0.00007       4.3
   52        0.00007       4.3
   61        0.00005       4.3
   71        0.00001       4.3
  END HYDR-INIT
  SANDFG
    RCHRES *** 1-Toffaletti, 2- Colby, 3- Power Function
    #    # SDFG ***
   11   71    3
  END SANDFG
  SED-GENPARM
    RCHRES ***BEDWID    BEDWRN       POR
    #    # *** (M)       (M)
  11          1.00       0.5       0.5
  12          0.70       0.5       0.5
  13          0.60       0.5       0.5
  14          1.50       0.5       0.5
  21          0.50       0.5       0.5
  31          1.50       0.5       0.5
  41          1.00       0.5       0.5
  51          1.00       0.5       0.5
  52          0.70       0.5       0.5
  61          0.70       0.5       0.5
  71          0.30       0.5       0.5
 END SED-GENPARM
 SAND-PM
   RCHRES ***      D          W         RHO      KSAND     EXPSND
   #    # ***    (MM)      (MM/S)     (G/CM3)
  11   71       0.10        5.0        2.65       0.50       0.60
 END SAND-PM
 SILT-CLAY-PM
   RCHRES ***      D          W         RHO      TAUCD      TAUCS          M
   #    # ***    (MM)      (MM/S)     (G/CM3)    (KG/M2)    (KG/M2)  (KG/M2.D)
  11   71      0.005     0.016         2.6      1.800      1.800       0.02
 END SILT-CLAY-PM
 SILT-CLAY-PM
   RCHRES ***      D          W         RHO      TAUCD      TAUCS          M
   #    # ***    (MM)      (MM/S)     (G/CM3)    (KG/M2)    (KG/M2)  (KG/M2.D)
  11   71     0.0010   0.00180         2.6      0.800      0.800      0.002
 END SILT-CLAY-PM
 SSED-INIT
   RCHRES *** SUSPENDED SED CONCS (MG/L)
   #    # ***   SAND       SILT       CLAY
  11   71       0.01        0.2        0.5
 END SSED-INIT
 BED-INIT
   RCHRES ***BEDDEP  INITIAL BED COMPOSITION
   #    # ***    (M)       SAND       SILT       CLAY
  11   71       0.05        .20        .40        .40
 END BED-INIT
 *** SECTION CONS FOR PHOSPHORUS
 NCONS
   RCHRES     ***
   # -  #NCONS***
  11   71    1
 END NCONS
 CONS-DATA
   RCHRES DATA FOR PHOSPHORUS ***
   # -  #          SUBSTANCE-ID ***  CONC         ID       CONV      QTYID
  11   71          PHOSPHORUS       0.000       UG/L      1.E06         KG
 END CONS-DATA
ND RCHRES
LTGEN
  PLOTINFO
    # -  # file  npt  nmn labl  pyr pivl  ***
    1        81         2         12   48
  END PLOTINFO
  GEN-LABELS
    # -  #<-------------------title-------------> ***      <-------ylabel----->
    1       Pittock Test (Goring) Phosphorus Loss                  Kg/day
  END GEN-LABELS
  SCALING
    # -  #         YMIN       YMAX      IVLIN   ***
    1                          1.5        10.
  END SCALING
  CURV-DATA
    # -  #     <---label------> line intg  col tran  ***
    1          Simulated                     1
  END CURV-DATA
  CURV-DATA
    # -  #     <---label------> line intg  col tran  ***
    1          Observed                      2
  END CURV-DATA
END PLTGEN
***
FTABLES
<--DEPTH-><--AREA--><-VOLUME-><-------------F(VOL)***(NCOLS-3)F10.0------------>
  FTABLE     110
  ROW   COL   ***
    8     4
   <DEPTH>       <AREA>   <VOLUME>      <FLOW> ***
      0.00         .000     0.0000         0.0
      0.10         .042    .000042      .0382
      0.20         .062    .000124      .1782
      0.50         .103    .000514      1.365
      0.80         .133     .00107      3.879
      1.20         .167     .00200      9.550
      2.00         .222     .00444     29.72
      3.00         .278     .00834     73.17
  END FTABLE110
  FTABLE     120
  ROW   COL   ***
    7     4
   <DEPTH>       <AREA>   <VOLUME>      <FLOW> ***
      0.00         .000     0.0000         0.0
      0.10        .0735   .0000735      .0400
      0.20        .1020   .0002036      .1757
      0.50        .1566   .0007831      1.245
      0.80        .1954    .001563      3.399
      1.20        .2364    .002840      8.083
      2.00        .3005    .006010      24.08
  END FTABLE120
  FTABLE     130
  ROW   COL   ***
    7     4
   <DEPTH>       <AREA>   <VOLUME>      <FLOW>               ***
      0.00         .000     0.0000         0.0
      0.10        .0942    .000094      .0256
      0.20        .1305    .000261      .1125
      0.50        .2007    .001004      .797
      0.80        .2504    .002003      2.176
      1.20        .3029    .003635      5.176
      2.00        .3852    .007703      15.42
  END FTABLE130
  FTABLE     140
  ROW   COL   ***
    7     4
   <DEPTH>       <AREA>   <VOLUME>      <FLOW> ***
      0.00         .000     0.0000         0.0
      0.10        .0825    .000083      .0259
      0.20        .1782    .000356      .177
      0.50        .4933    .002466      2.26
      0.80        .8315    .006652      8.34
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     1.20       1.305   .01566      25.72
     2.00       2.302   .04603      106.3
END FTABLE140
FTABLE     210
ROW  COL   ***
  7    4
 <DEPTH>      <AREA>  <VOL'ME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .062  .000062      .02633
     0.20        .086  .000172      .1156
     0.50        .132  .000661      .8193
     0.80        .165  .00132       2.237
     1.20        .199  .00239       5.319
     2.00        .254  .00507       15.84
     3.00        .307  .00920       37.68
END FTABLE210
FTABLE     310
ROW  COL   ***
  7    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW>                 ***
     0.00        .000   0.0000         0.0
     0.10        .095  .000095      .0354
     0.20        .204  .000408      .243
     0.50        .565  .00283       3.095
     0.80        .953  .00762       11.42
     1.20       1.495  .01790       35.22
     2.00       2.636  .05270       145.2
END FTABLE310
FTABLE     410
ROW  COL   ***
  7    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .146  .000146      .0222
     0.20        .272  .000544      .1313
     0.50        .619  .00310       1.376
     0.80        .944  .00755       4.593
     1.20       1.358  .01630       12.99
     2.00       2.148  .0430        48.14
END FTABLE410
FTABLE     510
ROW  COL   ***
  7    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .065  .000065      .0392
     0.20        .096  .000191      .183
     0.50        .159  .000795      1.40
     0.80        .206  .00165       3.98
     1.20        .259  .00310       9.80
     2.00        .343  .00687       30.49
END FTABLE510
FTABLE     520
ROW  COL   ***
  8    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .069  .000069      .02412
     0.20        .101  .000202      .1123
     0.50        .168  .000839      .8602
     0.80        .218  .00174       2.444
     1.20        .273  .00327       6.019
     2.00        .362  .00725       18.73
     3.00        .454  .01360       46.11
END FTABLE520
FTABLE     610
ROW  COL   ***
  8    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .051  .000051      .0355
     0.20        .071  .000142      .1563
     0.50        .109  .000545      1.107
     0.80        .136  .00109       3.022
     1.20        .164  .00197       7.187
     2.00        .209  .00418       21.41
     3.00        .253  .00758       50.92
END FTABLE610
FTABLE     710
ROW  COL   ***
  8    4
 <DEPTH>      <AREA>  <VOLUME>      <FLOW> ***
     0.00        .000   0.0000         0.0
     0.10        .012  .000012      .00569
     0.20        .026  .000052      .0390
     0.50        .072  .000359      .4980
     0.80        .121  .000968      1.836
     1.20        .190  .00228       5.662
     2.00        .335  .0067        23.40
     3.00        .525  .0158        72.17
END FTABLE710
END FTABLES
 **
XT SOURCES
<-VOLUME-> <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS> <-GRP> <-MEMBER->  ***
NAME>    # <NAME> # TEM STRG<-FACTOR->STRG <NAME>   #   #        <NAME> # #  ***
TSS     11 PTMPR    METR                SUM  PERLND 116 744 EXTNL  PREC
TSS     13 PMAT     METR                SAME PERLND 116 744 ATEMP  AIRTMP
TSS     14 PMWS     METR                SAME PERLND 116 744 EXTNL  WINMOV
TSS     15 PMSR     METR                DIV  PERLND 116 744 EXTNL  SOLRAD
TSS     16 PMEV     METR                DIV  PERLND 116 744 EXTNL  PETINP
TSS     17 PMDP     METR                SAME PERLND 116 744 EXTNL  DTMPG
TSS    401 STTP1    METR                     PLTGEN   1     INPUT  MEAN   1
TSS    121 OTQPT    METR                     PLTGEN   1     INPUT  MEAN   2
TSS    301 STSS1*** METR                     PLTGEN   1     INPUT  MEAN   1
TSS    111 OTQSS*** METR        .001         PLTGEN   1     INPUT  MEAN   2
TSS    201 STF1 *** METR    1000000.         PLTGEN   1     INPUT  MEAN   1
TSS    101 OTHF *** METR       3600.         PLTGEN   1     INPUT  MEAN   2
ND EXT SOURCES
***
NETWORK
<-VOLUME-> < GRP> <-MEMBER-><-FACTOR->TRAN < TARGET VOLS> < GRP> <-MEMBER->***
***ROUTE RUNOFF WATER TO REACHES
*** FIRST SURFACE RUNOFF, SECOND INTERFLOW, THIRD GROUNDWATER
PERLND 116 PWATER PERO        .00000694      RCHRES  41      INFLOW IVOL
PERLND 121 PWATER PERO        .0000376       RCHRES  12      INFLOW IVOL
PERLND 121 PWATER PERO        .0001187       RCHRES  21      INFLOW IVOL
PERLND 122 PWATER PERO        .0000722       RCHRES  12      INFLOW IVOL
PERLND 122 PWATER PERO        .0000101       RCHRES  41      INFLOW IVOL
PERLND 122 PWATER PERO        .00000463      RCHRES  51      INFLOW IVOL
PERLND 123 PWATER PERO        .00000534     RCHRES  11     INFLOW IVOL
PERLND 123 PWATER PERO        .0000276      RCHRES  12     INFLOW IVOL
PERLND 123 PWATER PERO        .0000152      RCHRES  21     INFLOW IVOL
PERLND 123 PWATER PERO        .0000267      RCHRES  41     INFLOW IVOL
PERLND 123 PWATER PERO        .0000575      RCHRES  51     INFLOW IVOL
PERLND 124 PWATER PERO        .0000366      RCHRES  11     INFLOW IVOL
PERLND 124 PWATER PERO        .0000443      RCHRES  12     INFLOW IVOL
PERLND 126 PWATER PERO        .0000128      RCHRES  41     INFLOW IVOL
PERLND 126 PWATER PERO        .0000135      RCHRES  51     INFLOW IVOL
PERLND 129 PWATER SURO        .0000481      RCHRES  14     INFLOW IVOL
PERLND 129 PWATER IFWO        .0000481      RCHRES  13     INFLOW IVOL
PERLND 129 PWATER AGWO        .0000481      RCHRES  13     INFLOW IVOL
PERLND 129 PWATER SURO        .0000458      RCHRES  31     INFLOW IVOL
PERLND 129 PWATER IFWO        .0000458      RCHRES  12     INFLOW IVOL
PERLND 129 PWATER AGWO        .0000458      RCHRES  12     INFLOW IVOL
PERLND 129 PWATER PERO        .0000118      RCHRES  41     INFLOW IVOL
PERLND 131 PWATER PERO        .0000187      RCHRES  41     INFLOW IVOL
PERLND 133 PWATER PERO        .0000250      RCHRES  12     INFLOW IVOL
PERLND 140 PWATER PERO        .0000189      RCHRES  41     INFLOW IVOL
PERLND 141 PWATER PERO        .0000326      RCHRES  11     INFLOW IVOL
PERLND 141 PWATER PERO        .0000396      RCHRES  13     INFLOW IVOL
PERLND 141 PWATER PERO        .0000115      RCHRES  21     INFLOW IVOL
PERLND 141 PWATER SURO        .0000142      RCHRES  31     INFLOW IVOL
PERLND 141 PWATER IFWO        .0000142      RCHRES  12     INFLOW IVOL
PERLND 141 PWATER AGWO        .0000142      RCHRES  12     INFLOW IVOL
PERLND 141 PWATER PERO        .0000125      RCHRES  41     INFLOW IVOL
PERLND 141 PWATER PERO        .00000935     RCHRES  51     INFLOW IVOL
PERLND 141 PWATER PERO        .0000694      RCHRES  52     INFLOW IVOL
PERLND 141 PWATER PERO        .0001016      RCHRES  61     INFLOW IVOL
PERLND 141 PWATER PERO        .00000568     RCHRES  71     INFLOW IVOL
PERLND 142 PWATER PERO        .0000115      RCHRES  41     INFLOW IVOL
PERLND 142 PWATER PERO        .0000507      RCHRES  52     INFLOW IVOL
PERLND 142 PWATER PERO        .0000264      RCHRES  71     INFLOW IVOL
PERLND 143 PWATER PERO        .0000477      RCHRES  11     INFLOW IVOL
PERLND 143 PWATER PERO        .0000479      RCHRES  13     INFLOW IVOL
PERLND 143 PWATER SURO        .00000517     RCHRES  14     INFLOW IVOL
PERLND 143 PWATER IFWO        .00000517     RCHRES  13     INFLOW IVOL
PERLND 143 PWATER AGWO        .00000517     RCHRES  13     INFLOW IVOL
PERLND 143 PWATER PERO        .0000718      RCHRES  21     INFLOW IVOL
PERLND 143 PWATER SURO        .0000151      RCHRES  31     INFLOW IVOL
PERLND 143 PWATER IFWO        .0000151      RCHRES  12     INFLOW IVOL
PERLND 143 PWATER AGWO        .0000151      RCHRES  12     INFLOW IVOL
PERLND 143 PWATER PERO        .0001556      RCHRES  41     INFLOW IVOL
PERLND 143 PWATER PERO        .0000263      RCHRES  52     INFLOW IVOL
PERLND 143 PWATER PERO        .0001042      RCHRES  71     INFLOW IVOL
PERLND 144 PWATER PERO        .00000826     RCHRES  12     INFLOW IVOL
PERLND 146 PWATER PERO        .0000386      RCHRES  13     INFLOW IVOL
PERLND 146 PWATER PERO        .0000486      RCHRES  41     INFLOW IVOL
PERLND 146 PWATER PERO        .0000640      RCHRES  51     INFLOW IVOL
PERLND 149 PWATER PERO        .0003385      RCHRES  13     INFLOW IVOL
PERLND 149 PWATER SURO        .0002260      RCHRES  14     INFLOW IVOL
PERLND 149 PWATER IFWO        .0002260      RCHRES  13     INFLOW IVOL
PERLND 149 PWATER AGWO        .0002260      RCHRES  13     INFLOW IVOL
PERLND 149 PWATER SURO        .0001860      RCHRES  31     INFLOW IVOL
PERLND 149 PWATER IFWO        .0001860      RCHRES  12     INFLOW IVOL
PERLND 149 PWATER AGWO        .0001860      RCHRES  12     INFLOW IVOL
PERLND 149 PWATER PERO        .0000498      RCHRES  61     INFLOW IVOL
PERLND 149 PWATER PERO        .0001249      RCHRES  71     INFLOW IVOL
PERLND 213 PWATER PERO        .0000342      RCHRES  41     INFLOW IVOL
PERLND 224 PWATER PERO        .0000315      RCHRES  11     INFLOW IVOL
PERLND 226 PWATER PERO        .0000121      RCHRES  51     INFLOW IVOL
PERLND 233 PWATER PERO        .0000096      RCHRES  11     INFLOW IVOL
PERLND 241 PWATER PERO        .00000893     RCHRES  21     INFLOW IVOL
PERLND 243 PWATER SURO        .0000115      RCHRES  14     INFLOW IVOL
PERLND 243 PWATER IFWO        .0000115      RCHRES  13     INFLOW IVOL
PERLND 243 PWATER AGWO        .0000115      RCHRES  13     INFLOW IVOL
PERLND 244 PWATER PERO        .0000197      RCHRES  11     INFLOW IVOL
PERLND 249 PWATER PERO        .00000664     RCHRES  13     INFLOW IVOL
PERLND 249 PWATER SURO        .0000135      RCHRES  14     INFLOW IVOL
PERLND 249 PWATER IFWO        .0000135      RCHRES  13     INFLOW IVOL
PERLND 249 PWATER AGWO        .0000135      RCHRES  13     INFLOW IVOL
PERLND 249 PWATER PERO        .00000923     RCHRES  61     INFLOW IVOL
PERLND 614 PWATER PERO        .0000113      RCHRES  13     INFLOW IVOL
PERLND 623 PWATER PERO        .0000702      RCHRES  21     INFLOW IVOL
PERLND 623 PWATER PERO        .00000493     RCHRES  51     INFLOW IVOL
PERLND 624 PWATER PERO        .0000290      RCHRES  21     INFLOW IVOL
PERLND 624 PWATER PERO        .00000456     RCHRES  51     INFLOW IVOL
PERLND 625 PWATER PERO        .0000312      RCHRES  51     INFLOW IVOL
PERLND 643 PWATER PERO        .0001766      RCHRES  13     INFLOW IVOL
PERLND 643 PWATER PERO        .0000490      RCHRES  41     INFLOW IVOL
PERLND 643 PWATER PERO        .0000468      RCHRES  51     INFLOW IVOL
PERLND 643 PWATER PERO        .0000515      RCHRES  52     INFLOW IVOL
PERLND 644 PWATER PERO        .0001183      RCHRES  13     INFLOW IVOL
PERLND 644 PWATER SURO        .0000522      RCHRES  31     INFLOW IVOL
PERLND 644 PWATER IFWO        .0000522      RCHRES  12     INFLOW IVOL
PERLND 644 PWATER AGWO        .0000522      RCHRES  12     INFLOW IVOL
PERLND 644 PWATER PERO        .0000088      RCHRES  41     INFLOW IVOL
PERLND 644 PWATER PERO        .0000471      RCHRES  51     INFLOW IVOL
PERLND 644 PWATER PERO        .0000474      RCHRES  61     INFLOW IVOL
PERLND 645 PWATER PERO        .00000912     RCHRES  12     INFLOW IVOL
PERLND 645 PWATER PERO        .0000154      RCHRES  13     INFLOW IVOL
PERLND 645 PWATER PERO        .0000323      RCHRES  41     INFLOW IVOL
PERLND 743 PWATER PERO        .0000155      RCHRES  51     INFLOW IVOL
PERLND 744 PWATER PERO        .00000847     RCHRES  41     INFLOW IVOL
***
*** ROUTE PHOSPHORUS RUNOFF TO REACHES
PERLND 116 PHOS   POPHOS          0.694     RCHRES  41     INFLOW ICON
PERLND 121 PHOS   POPHOS          3.76      RCHRES  12     INFLOW ICON
PERLND 121 PHOS   POPHOS         11.87      RCHRES  21     INFLOW ICON
PERLND 122 PHOS   POPHOS          7.22      RCHRES  12     INFLOW ICON
PERLND 122 PHOS   POPHOS          1.01      RCHRES  41     INFLOW ICON
PERLND 122 PHOS   POPHOS          0.463     RCHRES  51     INFLOW ICON
PERLND 123 PHOS   POPHOS          0.534     RCHRES  11     INFLOW ICON
PERLND 123 PHOS   POPHOS          2.76      RCHRES  12     INFLOW ICON
PERLND 123 PHOS   POPHOS          1.52      RCHRES  21     INFLOW ICON
PERLND 123 PHOS   POPHOS          2.67      RCHRES  41     INFLOW ICON
PERLND 123 PHOS   POPHOS          5.75      RCHRES  51     INFLOW ICON
PERLND 124 PHOS   POPHOS          3.66      RCHRES  11     INFLOW ICON
PERLND 124 PHOS   POPHOS          4.43      RCHRES  12     INFLOW ICON
PERLND 126 PHOS   POPHOS          1.28      RCHRES  41     INFLOW ICON
PERLND 126 PHOS   POPHOS          1.35      RCHRES  51     INFLOW ICON
PERLND 129 PHOS   SOSEDP 1 1      4.81      RCHRES  14     INFLOW ICON
PERLND 129 PHOS   TSP4S  1 1      4.81      RCHRES  14     INFLOW ICON
PERLND 129 PHOS   TSP4S  5 1      4.81      RCHRES  13     INFLOW ICON
PERLND 129 PHOS   SSP4S  3 1      4.81      RCHRES  13     INFLOW ICON
PERLND 129 PHOS   SOSEDP 1 1      4.58      RCHRES  31     INFLOW ICON
PERLND 129 PHOS   TSP4S  1 1      4.58      RCHRES  31     INFLOW ICON
PERLND 129 PHOS   TSP4S  5 1      4.58      RCHRES  12     INFLOW ICON
PERLND 129 PHOS   SSP4S  3 1      4.58      RCHRES  12     INFLOW ICON
PERLND 129 PHOS   POPHOS          1.18      RCHRES  41     INFLOW ICON
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ERLND 131 PHOS   POPHOS          1.87     RCHRES  41     INFLOW ICON
ERLND 133 PHOS   POPHOS          2.50     RCHRES  12     INFLOW ICON
ERLND 140 PHOS   POPHOS          1.89     RCHRES  41     INFLOW ICON
ERLND 141 PHOS   POPHOS          3.26     RCHRES  11     INFLOW ICON
ERLND 141 PHOS   POPHOS          3.96     RCHRES  13     INFLOW ICON
ERLND 141 PHOS   POPHOS          1.15     RCHRES  21     INFLOW ICON
ERLND 141 PHOS   SOSEDP 1 1      1.42     RCHRES  31     INFLOW ICON
ERLND 141 PHOS   TSP4S  1 1      1.42     RCHRES  31     INFLOW ICON
ERLND 141 PHOS   TSP4S  5 1      1.42     RCHRES  12     INFLOW ICON
ERLND 141 PHOS   SSP4S  3 1      1.42     RCHRES  12     INFLOW ICON
ERLND 141 PHOS   POPHOS          1.25     RCHRES  41     INFLOW ICON
ERLND 141 PHOS   POPHOS          0.935    RCHRES  51     INFLOW ICON
ERLND 141 PHOS   POPHOS          6.94     RCHRES  52     INFLOW ICON
ERLND 141 PHOS   POPHOS         10.16     RCHRES  61     INFLOW ICON
ERLND 141 PHOS   POPHOS          0.568    RCHRES  71     INFLOW ICON
ERLND 142 PHOS   POPHOS          1.15     RCHRES  41     INFLOW ICON
ERLND 142 PHOS   POPHOS          5.07     RCHRES  52     INFLOW ICON
ERLND 142 PHOS   POPHOS          2.64     RCHRES  71     INFLOW ICON
ERLND 143 PHOS   POPHOS          4.77     RCHRES  11     INFLOW ICON
ERLND 143 PHOS   POPHOS          4.79     RCHRES  13     INFLOW ICON
ERLND 143 PHOS   SOSEDP 1 1      0.517    RCHRES  14     INFLOW ICON
ERLND 143 PHOS   TSP4S  1 1      0.517    RCHRES  14     INFLOW ICON
ERLND 143 PHOS   TSP4S  5 1      0.517    RCHRES  13     INFLOW ICON
ERLND 143 PHOS   SSP4S  3 1      0.517    RCHRES  13     INFLOW ICON
ERLND 143 PHOS   POPHOS          7.18     RCHRES  21     INFLOW ICON
ERLND 143 PHOS   SOSEDP 1 1      1.51     RCHRES  31     INFLOW ICON
ERLND 143 PHOS   TSP4S  1 1      1.51     RCHRES  31     INFLOW ICON
ERLND 143 PHOS   TSP4S  5 1      1.51     RCHRES  12     INFLOW ICON
ERLND 143 PHOS   SSP4S  3 1      1.51     RCHRES  12     INFLOW ICON
ERLND 143 PHOS   POPHOS         15.56     RCHRES  41     INFLOW ICON
ERLND 143 PHOS   POPHOS          2.63     RCHRES  52     INFLOW ICON
ERLND 143 PHOS   POPHOS         10.42     RCHRES  71     INFLOW ICON
ERLND 144 PHOS   POPHOS          0.826    RCHRES  12     INFLOW ICON
ERLND 146 PHOS   POPHOS          3.86     RCHRES  13     INFLOW ICON
ERLND 146 PHOS   POPHOS          4.86     RCHRES  41     INFLOW ICON
ERLND 146 PHOS   POPHOS          6.40     RCHRES  51     INFLOW ICON
ERLND 149 PHOS   POPHOS         33.85     RCHRES  13     INFLOW ICON
ERLND 149 PHOS   SOSEDP 1 1     22.60     RCHRES  14     INFLOW ICON
ERLND 149 PHOS   TSP4S  1 1     22.60     RCHRES  14     INFLOW ICON
ERLND 149 PHOS   TSP4S  5 1     22.60     RCHRES  13     INFLOW ICON
ERLND 149 PHOS   SSP4S  3 1     22.60     RCHRES  13     INFLOW ICON
ERLND 149 PHOS   SOSEDP 1 1     18.60     RCHRES  31     INFLOW ICON
ERLND 149 PHOS   TSP4S  1 1     18.60     RCHRES  31     INFLOW ICON
ERLND 149 PHOS   TSP4S  5 1     18.60     RCHRES  12     INFLOW ICON
ERLND 149 PHOS   SSP4S  3 1     18.60     RCHRES  12     INFLOW ICON
ERLND 149 PHOS   POPHOS          4.98     RCHRES  61     INFLOW ICON
ERLND 149 PHOS   POPHOS         12.49     RCHRES  71     INFLOW ICON
ERLND 213 PHOS   POPHOS          3.42     RCHRES  41     INFLOW ICON
ERLND 224 PHOS   POPHOS          3.15     RCHRES  11     INFLOW ICON
ERLND 226 PHOS   POPHOS          1.21     RCHRES  51     INFLOW ICON
ERLND 233 PHOS   POPHOS          0.96     RCHRES  11     INFLOW ICON
ERLND 241 PHOS   POPHOS          0.893    RCHRES  21     INFLOW ICON
ERLND 243 PHOS   SOSEDP 1 1      1.15     RCHRES  14     INFLOW ICON
ERLND 243 PHOS   TSP4S  1 1      1.15     RCHRES  14     INFLOW ICON
ERLND 243 PHOS   TSP4S  5 1      1.15     RCHRES  13     INFLOW ICON
ERLND 243 PHOS   SSP4S  3 1      1.15     RCHRES  13     INFLOW ICON
ERLND 244 PHOS   POPHOS          1.97     RCHRES  11     INFLOW ICON
ERLND 249 PHOS   POPHOS          0.664    RCHRES  13     INFLOW ICON
ERLND 249 PHOS   SOSEDP 1 1      1.35     RCHRES  14     INFLOW ICON
ERLND 249 PHOS   TSP4S  1 1      1.35     RCHRES  14     INFLOW ICON
ERLND 249 PHOS   TSP4S  5 1      1.35     RCHRES  13     INFLOW ICON
ERLND 249 PHOS   SSP4S  3 1      1.35     RCHRES  13     INFLOW ICON
ERLND 249 PHOS   POPHOS          0.923    RCHRES  61     INFLOW ICON
ERLND 614 PHOS   POPHOS          1.13     RCHRES  13     INFLOW ICON
ERLND 623 PHOS   POPHOS          7.02     RCHRES  21     INFLOW ICON
ERLND 623 PHOS   POPHOS          0.493    RCHRES  51     INFLOW ICON
ERLND 624 PHOS   POPHOS          2.90     RCHRES  21     INFLOW ICON
ERLND 624 PHOS   POPHOS          0.456    RCHRES  51     INFLOW ICON
ERLND 625 PHOS   POPHOS          3.12     RCHRES  51     INFLOW ICON
ERLND 643 PHOS   POPHOS         17.66     RCHRES  13     INFLOW ICON
ERLND 643 PHOS   POPHOS          4.90     RCHRES  41     INFLOW ICON
ERLND 643 PHOS   POPHOS          4.68     RCHRES  51     INFLOW ICON
ERLND 643 PHOS   POPHOS          5.15     RCHRES  52     INFLOW ICON
ERLND 644 PHOS   POPHOS         11.83     RCHRES  13     INFLOW ICON
ERLND 644 PHOS   SOSEDP 1 1      5.22     RCHRES  31     INFLOW ICON
ERLND 644 PHOS   TSP4S  1 1      5.22     RCHRES  31     INFLOW ICON
ERLND 644 PHOS   TSP4S  5 1      5.22     RCHRES  12     INFLOW ICON
ERLND 644 PHOS   SSP4S  3 1      5.22     RCHRES  12     INFLOW ICON
ERLND 644 PHOS   POPHOS          0.88     RCHRES  41     INFLOW ICON
ERLND 644 PHOS   POPHOS          4.71     RCHRES  51     INFLOW ICON
ERLND 644 PHOS   POPHOS          4.74     RCHRES  61     INFLOW ICON
ERLND 645 PHOS   POPHOS          0.912    RCHRES  12     INFLOW ICON
ERLND 645 PHOS   POPHOS          1.54     RCHRES  13     INFLOW ICON
ERLND 645 PHOS   POPHOS          3.23     RCHRES  41     INFLOW ICON
ERLND 743 PHOS   POPHOS          1.55     RCHRES  51     INFLOW ICON
ERLND 744 PHOS   POPHOS          0.847    RCHRES  41     INFLOW ICON
**ROUTE SEDIMENT RUNOFF TO REACHES AS SAND SILT AND CLAY PARTICLES
ERLND 116 SEDMNT SOSED           0.139    RCHRES  41     INFLOW ISED  2
ERLND 116 SEDMNT SOSED           0.555    RCHRES  41     INFLOW ISED  3
ERLND 121 SEDMNT SOSED           0.752    RCHRES  12     INFLOW ISED  2
ERLND 121 SEDMNT SOSED           3.008    RCHRES  12     INFLOW ISED  3
ERLND 121 SEDMNT SOSED           2.374    RCHRES  21     INFLOW ISED  2
ERLND 121 SEDMNT SOSED           9.496    RCHRES  21     INFLOW ISED  3
ERLND 122 SEDMNT SOSED           1.444    RCHRES  12     INFLOW ISED  2
ERLND 122 SEDMNT SOSED           5.776    RCHRES  12     INFLOW ISED  3
ERLND 122 SEDMNT SOSED           0.20     RCHRES  41     INFLOW ISED  2
ERLND 122 SEDMNT SOSED           0.81     RCHRES  41     INFLOW ISED  3
PERLND 122 SEDMNT SOSED          0.093    RCHRES  51     INFLOW ISED  2
PERLND 122 SEDMNT SOSED          0.370    RCHRES  51     INFLOW ISED  3
PERLND 123 SEDMNT SOSED          0.107    RCHRES  11     INFLOW ISED  2
PERLND 123 SEDMNT SOSED          0.427    RCHRES  11     INFLOW ISED  3
PERLND 123 SEDMNT SOSED          0.552    RCHRES  12     INFLOW ISED  2
PERLND 123 SEDMNT SOSED          2.208    RCHRES  12     INFLOW ISED  3
PERLND 123 SEDMNT SOSED          0.304    RCHRES  21     INFLOW ISED  2
PERLND 123 SEDMNT SOSED          1.22     RCHRES  21     INFLOW ISED  3
PERLND 123 SEDMNT SOSED          0.534    RCHRES  41     INFLOW ISED  2
PERLND 123 SEDMNT SOSED          2.14     RCHRES  41     INFLOW ISED  3
PERLND 123 SEDMNT SOSED          1.14     RCHRES  51     INFLOW ISED  2
PERLND 123 SEDMNT SOSED          4.56     RCHRES  51     INFLOW ISED  3
PERLND 124 SEDMNT SOSED          0.732    RCHRES  11     INFLOW ISED  2
PERLND 124 SEDMNT SOSED          2.93     RCHRES  11     INFLOW ISED  3
PERLND 124 SEDMNT SOSED          0.88     RCHRES  12     INFLOW ISED  2
PERLND 124 SEDMNT SOSED          3.52     RCHRES  12     INFLOW ISED  3
PERLND 126 SEDMNT SOSED          0.256    RCHRES  41     INFLOW ISED  2
PERLND 126 SEDMNT SOSED          1.02     RCHRES  41     INFLOW ISED  3
PERLND 126 SEDMNT SOSED          0.27     RCHRES  51     INFLOW ISED  2
PERLND 126 SEDMNT SOSED          1.08     RCHRES  51     INFLOW ISED  3
PERLND 129 SEDMNT SOSED          0.962    RCHRES  14     INFLOW ISED  2
PERLND 129 SEDMNT SOSED          3.85     RCHRES  14     INFLOW ISED  3
PERLND 129 SEDMNT SOSED          0.916    RCHRES  31     INFLOW ISED  2
PERLND 129 SEDMNT SOSED          3.66      RCHRES  31      INFLOW ISED  3
RLND 129 SEDMNT SOSED            0.236     RCHRES  41      INFLOW ISED  2
RLND 129 SEDMNT SOSED            0.944     RCHRES  41      INFLOW ISED  3
RLND 131 SEDMNT SOSED            0.374     RCHRES  41      INFLOW ISED  2
RLND 131 SEDMNT SOSED            1.496     RCHRES  41      INFLOW ISED  3
PERLND 133 SEDMNT SOSED          0.50      RCHRES  12      INFLOW ISED  2
PERLND 133 SEDMNT SOSED          2.00      RCHRES  12      INFLOW ISED  3
PERLND 140 SEDMNT SOSED          0.378     RCHRES  41      INFLOW ISED  2
RLND 140 SEDMNT SOSED            1.51      RCHRES  41      INFLOW ISED  3
RLND 141 SEDMNT SOSED            0.65      RCHRES  11      INFLOW ISED  2
RLND 141 SEDMNT SOSED            2.61      RCHRES  11      INFLOW ISED  3
PERLND 141 SEDMNT SOSED          0.79      RCHRES  13      INFLOW ISED  2
PERLND 141 SEDMNT SOSED          3.17      RCHRES  13      INFLOW ISED  3
PERLND 141 SEDMNT SOSED          0.23      RCHRES  21      INFLOW ISED  2
ERLND 141 SEDMNT SOSED           0.92      RCHRES  21      INFLOW ISED  3
ERLND 141 SEDMNT SOSED           0.28      RCHRES  31      INFLOW ISED  2
ERLND 141 SEDMNT SOSED           1.12      RCHRES  31      INFLOW ISED  3
ERLND 141 SEDMNT SOSED           0.25      RCHRES  41      INFLOW ISED  2
PERLND 141 SEDMNT SOSED          1.00      RCHRES  41      INFLOW ISED  3
PERLND 141 SEDMNT SOSED          0.187     RCHRES  51      INFLOW ISED  2
PERLND 141 SEDMNT SOSED          0.748     RCHRES  51      INFLOW ISED  3
ERLND 141 SEDMNT SOSED           1.388     RCHRES  52      INFLOW ISED  2
ERLND 141 SEDMNT SOSED           5.55      RCHRES  52      INFLOW ISED  3
ERLND 141 SEDMNT SOSED           2.03      RCHRES  61      INFLOW ISED  2
ERLND 141 SEDMNT SOSED           8.13      RCHRES  61      INFLOW ISED  3
PERLND 141 SEDMNT SOSED          0.114     RCHRES  71      INFLOW ISED  2
PERLND 141 SEDMNT SOSED          0.454     RCHRES  71      INFLOW ISED  3
ERLND 142 SEDMNT SOSED           0.23      RCHRES  41      INFLOW ISED  2
ERLND 142 SEDMNT SOSED           0.92      RCHRES  41      INFLOW ISED  3
ERLND 142 SEDMNT SOSED           1.01      RCHRES  52      INFLOW ISED  2
ERLND 142 SEDMNT SOSED           4.06      RCHRES  52      INFLOW ISED  3
PERLND 142 SEDMNT SOSED          0.528     RCHRES  71      INFLOW ISED  2
PERLND 142 SEDMNT SOSED          2.11      RCHRES  71      INFLOW ISED  3
PERLND 143 SEDMNT SOSED          0.95      RCHRES  11      INFLOW ISED  2
ERLND 143 SEDMNT SOSED           3.82      RCHRES  11      INFLOW ISED  3
ERLND 143 SEDMNT SOSED           0.96      RCHRES  13      INFLOW ISED  2
ERLND 143 SEDMNT SOSED           3.83      RCHRES  13      INFLOW ISED  3
ERLND 143 SEDMNT SOSED           0.103     RCHRES  14      INFLOW ISED  2
PERLND 143 SEDMNT SOSED          0.414     RCHRES  14      INFLOW ISED  3
PERLND 143 SEDMNT SOSED          1.44      RCHRES  21      INFLOW ISED  2
ERLND 143 SEDMNT SOSED           5.74      RCHRES  21      INFLOW ISED  3
ERLND 143 SEDMNT SOSED           0.30      RCHRES  31      INFLOW ISED  2
ERLND 143 SEDMNT SOSED           1.21      RCHRES  31      INFLOW ISED  3
ERLND 143 SEDMNT SOSED           3.11      RCHRES  41      INFLOW ISED  2
ERLND 143 SEDMNT SOSED          12.45      RCHRES  41      INFLOW ISED  3
PERLND 143 SEDMNT SOSED          0.53      RCHRES  52      INFLOW ISED  2
PERLND 143 SEDMNT SOSED          2.13      RCHRES  52      INFLOW ISED  3
ERLND 143 SEDMNT SOSED           2.08      RCHRES  71      INFLOW ISED  2
ERLND 143 SEDMNT SOSED           8.34      RCHRES  71      INFLOW ISED  3
ERLND 144 SEDMNT SOSED           0.165     RCHRES  12      INFLOW ISED  2
ERLND 144 SEDMNT SOSED           0.661     RCHRES  12      INFLOW ISED  3
PERLND 146 SEDMNT SOSED          0.77      RCHRES  13      INFLOW ISED  2
PERLND 146 SEDMNT SOSED          3.09      RCHRES  13      INFLOW ISED  3
ERLND 146 SEDMNT SOSED           0.97      RCHRES  41      INFLOW ISED  2
ERLND 146 SEDMNT SOSED           3.89      RCHRES  41      INFLOW ISED  3
ERLND 146 SEDMNT SOSED           1.28      RCHRES  51      INFLOW ISED  2
ERLND 146 SEDMNT SOSED           5.12      RCHRES  51      INFLOW ISED  3
ERLND 149 SEDMNT SOSED           6.77      RCHRES  13      INFLOW ISED  2
PERLND 149 SEDMNT SOSED         27.08      RCHRES  13      INFLOW ISED  3
PERLND 149 SEDMNT SOSED          4.52      RCHRES  14      INFLOW ISED  2
ERLND 149 SEDMNT SOSED          18.08      RCHRES  14      INFLOW ISED  3
ERLND 149 SEDMNT SOSED           3.72      RCHRES  31      INFLOW ISED  2
ERLND 149 SEDMNT SOSED          14.88      RCHRES  31      INFLOW ISED  3
ERLND 149 SEDMNT SOSED           1.00      RCHRES  61      INFLOW ISED  2
PERLND 149 SEDMNT SOSED          3.98      RCHRES  61      INFLOW ISED  3
PERLND 149 SEDMNT SOSED          2.50      RCHRES  71      INFLOW ISED  2
PERLND 149 SEDMNT SOSED         10.00      RCHRES  71      INFLOW ISED  3
ERLND 213 SEDMNT SOSED           0.68      RCHRES  41      INFLOW ISED  2
ERLND 213 SEDMNT SOSED           2.74      RCHRES  41      INFLOW ISED  3
ERLND 224 SEDMNT SOSED           0.63      RCHRES  11      INFLOW ISED  2
ERLND 224 SEDMNT SOSED           2.52      RCHRES  11      INFLOW ISED  3
PERLND 226 SEDMNT SOSED          0.24      RCHRES  51      INFLOW ISED  2
PERLND 226 SEDMNT SOSED          0.97      RCHRES  51      INFLOW ISED  3
ERLND 233 SEDMNT SOSED           0.19      RCHRES  11      INFLOW ISED  2
ERLND 233 SEDMNT SOSED           0.77      RCHRES  11      INFLOW ISED  3
ERLND 241 SEDMNT SOSED           0.179     RCHRES  21      INFLOW ISED  2
ERLND 241 SEDMNT SOSED           0.714     RCHRES  21      INFLOW ISED  3
PERLND 243 SEDMNT SOSED          0.23      RCHRES  14      INFLOW ISED  2
PERLND 243 SEDMNT SOSED          0.92      RCHRES  14      INFLOW ISED  3
ERLND 244 SEDMNT SOSED           0.39      RCHRES  11      INFLOW ISED  2
ERLND 244 SEDMNT SOSED           1.58      RCHRES  11      INFLOW ISED  3
ERLND 249 SEDMNT SOSED           0.133     RCHRES  13      INFLOW ISED  2
ERLND 249 SEDMNT SOSED           0.531     RCHRES  13      INFLOW ISED  3
ERLND 249 SEDMNT SOSED           0.27      RCHRES  14      INFLOW ISED  2
PERLND 249 SEDMNT SOSED          1.07      RCHRES  14      INFLOW ISED  3
PERLND 249 SEDMNT SOSED          0.185     RCHRES  61      INFLOW ISED  2
ERLND 249 SEDMNT SOSED           0.738     RCHRES  61      INFLOW ISED  3
ERLND 614 SEDMNT SOSED           0.23      RCHRES  13      INFLOW ISED  2
ERLND 614 SEDMNT SOSED           0.90      RCHRES  13      INFLOW ISED  3
ERLND 623 SEDMNT SOSED           1.40      RCHRES  21      INFLOW ISED  2
PERLND 623 SEDMNT SOSED          5.62      RCHRES  21      INFLOW ISED  3
PERLND 623 SEDMNT SOSED          0.099     RCHRES  51      INFLOW ISED  2
ERLND 623 SEDMNT SOSED           0.394     RCHRES  51      INFLOW ISED  3
ERLND 624 SEDMNT SOSED           0.58      RCHRES  21      INFLOW ISED  2
ERLND 624 SEDMNT SOSED           2.32      RCHRES  21      INFLOW ISED  3
ERLND 624 SEDMNT SOSED           0.091     RCHRES  51      INFLOW ISED  2
PERLND 624 SEDMNT SOSED          0.365     RCHRES  51      INFLOW ISED  3
PERLND 625 SEDMNT SOSED          0.624     RCHRES  51      INFLOW ISED  2
PERLND 625 SEDMNT SOSED          2.50      RCHRES  51      INFLOW ISED  3
ERLND 643 SEDMNT SOSED           3.53      RCHRES  13      INFLOW ISED  2
ERLND 643 SEDMNT SOSED          14.13      RCHRES  13      INFLOW ISED  3
ERLND 643 SEDMNT SOSED           0.98      RCHRES  41      INFLOW ISED  2
ERLND 643 SEDMNT SOSED           3.92      RCHRES  41      INFLOW ISED  3
PERLND 643 SEDMNT SOSED          0.936     RCHRES  51      INFLOW ISED  2
PERLND 643 SEDMNT SOSED          3.74      RCHRES  51      INFLOW ISED  3
ERLND 643 SEDMNT SOSED           1.03      RCHRES  52      INFLOW ISED  2
ERLND 643 SEDMNT SOSED           4.12      RCHRES  52      INFLOW ISED  3
ERLND 644 SEDMNT SOSED           2.37      RCHRES  13      INFLOW ISED  2
ERLND 644 SEDMNT SOSED           9.46      RCHRES  13      INFLOW ISED  3
PERLND 644 SEDMNT SOSED          1.04      RCHRES  31      INFLOW ISED  2
PERLND 644 SEDMNT SOSED          4.18      RCHRES  31      INFLOW ISED  3
PERLND 644 SEDMNT SOSED          0.18      RCHRES  41      INFLOW ISED  2
ERLND 644 SEDMNT SOSED           0.70      RCHRES  41      INFLOW ISED  3
ERLND 644 SEDMNT SOSED           0.94      RCHRES  51      INFLOW ISED  2
ERLND 644 SEDMNT SOSED           3.77      RCHRES  51      INFLOW ISED  3
PERLND 644 SEDMNT SOSED          0.95      RCHRES  61      INFLOW ISED  2
PERLND 644 SEDMNT SOSED          3.79      RCHRES  61      INFLOW ISED  3
PERLND 645 SEDMNT SOSED          0.182     RCHRES  12      INFLOW ISED  2
ERLND 645 SEDMNT SOSED           0.730     RCHRES  12      INFLOW ISED  3
ERLND 645 SEDMNT SOSED           0.31      RCHRES  13      INFLOW ISED  2
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PERLND 645 SEDMNT SOSED          1.23       RCHRES  13      INFLOW ISED  3
PERLND 645 SEDMNT SOSED          0.65       RCHRES  41      INFLOW ISED  2
PERLND 645 SEDMNT SOSED          2.58       RCHRES  41      INFLOW ISED  3
PERLND 743 SEDMNT SOSED          0.31       RCHRES  51      INFLOW ISED  2
PERLND 743 SEDMNT SOSED          1.24       RCHRES  51      INFLOW ISED  3
PERLND 744 SEDMNT SOSED          0.169      RCHRES  41      INFLOW ISED  2
PERLND 744 SEDMNT SOSED          0.678      RCHRES  41      INFLOW ISED  3
***ROUTE ALL SIMULATED CONSTITUENTS BETWEEN REACHES
RCHRES  71 ROFLOW                           RCHRES  13      INFLOW
RCHRES  14 ROFLOW                           RCHRES  13      INFLOW
RCHRES  13 ROFLOW                           RCHRES  12      INFLOW
RCHRES  61 ROFLOW                           RCHRES  12      INFLOW
RCHRES  41 ROFLOW                           RCHRES  12      INFLOW
RCHRES  31 ROFLOW                           RCHRES  12      INFLOW
RCHRES  52 ROFLOW                           RCHRES  51      INFLOW
RCHRES  51 ROFLOW                           RCHRES  11      INFLOW
RCHRES  21 ROFLOW                           RCHRES  11      INFLOW
RCHRES  12 ROFLOW                           RCHRES  11      INFLOW
***
END NETWORK
***
EXT TARGETS
<-volume-> <-grp> <-member-><--mult-->Tran <-volume-> <member> tsys tgap Amd ***
<name>   #        <name> # #<-factor->strg <name>   # <name>    tem strg strg***
***SAVE FLOW IN TSS
RCHRES  11 HYDR   ROVOL                    TSS    201 STF1     METR      ADD
RCHRES  31 HYDR   ROVOL        ***         TSS    202 STF2     METR      ADD
RCHRES  14 HYDR   ROVOL        ***         TSS    203 STF3     METR      ADD
***SAVE SEDIMENT FLOW IN TSS
RCHRES  11 SEDTRN ROSED  4                 TSS    301 STSS1    METR      ADD
RCHRES  31 SEDTRN ROSED  4     ***         TSS    302 STSS2    METR      ADD
RCHRES  14 SEDTRN ROSED  4     ***         TSS    303 STSS3    METR      ADD
***SAVE PHOSPHORUS IN TSS
RCHRES  11 CONS   ROCON  1                 TSS    401 STTP1    METR      ADD
RCHRES  31 CONS   ROCON  1     ***         TSS    402 STTP2    METR      ADD
RCHRES  14 CONS   ROCON  1     ***         TSS    403 STTP3    METR      ADD
***
***  SAVE PERLND UNIT AREA RUNOFF
***  HYDROLOGY
PERLND 116 PWATER PERO         ***         TSS    501 WAT01    METR      ADD
PERLND 116 SNOW   WYIELD                   TSS    501 WAT01    METR      ADD
PERLND 116 SNOW   PACK                     TSS    502 WAT02    METR      ADD
PERLND 116 PWATER SURO                     TSS    503 WAT03    METR      ADD
PERLND 116 PWATER IFWO                     TSS    504 WAT04    METR      ADD
PERLND 116 PWATER AGWO                     TSS    505 WAT05    METR      ADD
PERLND 213 PWATER SURO         ***         TSS    506 WAT06    METR      ADD
PERLND 213 PWATER IFWO         ***         TSS    507 WAT07    METR      ADD
PERLND 213 PWATER AGWO         ***         TSS    508 WAT08    METR      ADD
PERLND 121 PWATER PERO         ***         TSS    502 WAT02    METR      ADD
PERLND 122 PWATER PERO         ***         TSS    503 WAT03    METR      ADD
PERLND 123 PWATER PERO         ***         TSS    504 WAT04    METR      ADD
PERLND 124 PWATER PERO         ***         TSS    505 WAT05    METR      ADD
PERLND 126 PWATER PERO                     TSS    506 WAT06    METR      ADD
PERLND 129 PWATER PERO                     TSS    507 WAT07    METR      ADD
PERLND 131 PWATER PERO                     TSS    508 WAT08    METR      ADD
PERLND 133 PWATER PERO                     TSS    509 WAT09    METR      ADD
PERLND 140 PWATER PERO                     TSS    510 WAT10    METR      ADD
PERLND 141 PWATER PERO                     TSS    511 WAT11    METR      ADD
PERLND 142 PWATER PERO                     TSS    512 WAT12    METR      ADD
PERLND 143 PWATER PERO                     TSS    513 WAT13    METR      ADD
PERLND 144 PWATER PERO                     TSS    514 WAT14    METR      ADD
PERLND 146 PWATER PERO                     TSS    515 WAT15    METR      ADD
PERLND 149 PWATER PERO                     TSS    516 WAT16    METR      ADD
PERLND 213 PWATER PERO                     TSS    517 WAT17    METR      ADD
PERLND 224 PWATER PERO                     TSS    518 WAT18    METR      ADD
PERLND 226 PWATER PERO                     TSS    519 WAT19    METR      ADD
PERLND 233 PWATER PERO                     TSS    520 WAT20    METR      ADD
PERLND 241 PWATER PERO                     TSS    521 WAT21    METR      ADD
PERLND 243 PWATER PERO                     TSS    522 WAT22    METR      ADD
PERLND 244 PWATER PERO                     TSS    523 WAT23    METR      ADD
PERLND 249 PWATER PERO                     TSS    524 WAT24    METR      ADD
PERLND 614 PWATER PERO                     TSS    525 WAT25    METR      ADD
PERLND 623 PWATER PERO                     TSS    526 WAT26    METR      ADD
PERLND 624 PWATER PERO                     TSS    527 WAT27    METR      ADD
PERLND 625 PWATER PERO                     TSS    528 WAT28    METR      ADD
PERLND 643 PWATER PERO                     TSS    529 WAT29    METR      ADD
PERLND 644 PWATER PERO                     TSS    530 WAT30    METR      ADD
PERLND 645 PWATER PERO                     TSS    531 WAT31    METR      ADD
PERLND 743 PWATER PERO                     TSS    532 WAT32    METR      ADD
PERLND 744 PWATER PERO                     TSS    533 WAT33    METR      ADD
***  SEDIMENTOLOGY
PERLND 116 SEDMNT WSSD                     TSS    701 SED01    METR      ADD
PERLND 116 SEDMNT SCRSD                    TSS    702 SED02    METR      ADD
PERLND 224 SEDMNT WSSD                     TSS    703 SED03    METR      ADD
PERLND 224 SEDMNT SCRSD                    TSS    704 SED04    METR      ADD
PERLND 116 SEDMNT DET                      TSS    705 SED05    METR      ADD
PERLND 121 SEDMNT SOSED        ***         TSS    702 SED02    METR      ADD
PERLND 122 SEDMNT SOSED        ***         TSS    703 SED03    METR      ADD
PERLND 123 SEDMNT SOSED        ***         TSS    704 SED04    METR      ADD
PERLND 124 SEDMNT SOSED        ***         TSS    705 SED05    METR      ADD
PERLND 126 SEDMNT SOSED                    TSS    706 SED06    METR      ADD
PERLND 129 SEDMNT SOSED                    TSS    707 SED07    METR      ADD
PERLND 131 SEDMNT SOSED                    TSS    708 SED08    METR      ADD
PERLND 133 SEDMNT SOSED                    TSS    709 SED09    METR      ADD
PERLND 140 SEDMNT SOSED                    TSS    710 SED10    METR      ADD
PERLND 141 SEDMNT SOSED                    TSS    711 SED11    METR      ADD
PERLND 142 SEDMNT SOSED                    TSS    712 SED12    METR      ADD
PERLND 143 SEDMNT SOSED                    TSS    713 SED13    METR      ADD
PERLND 144 SEDMNT SOSED                    TSS    714 SED14    METR      ADD
PERLND 146 SEDMNT SOSED                    TSS    715 SED15    METR      ADD
PERLND 149 SEDMNT SOSED                    TSS    716 SED16    METR      ADD
PERLND 213 SEDMNT SOSED                    TSS    717 SED17    METR      ADD
PERLND 224 SEDMNT SOSED                    TSS    718 SED18    METR      ADD
PERLND 226 SEDMNT SOSED                    TSS    719 SED19    METR      ADD
PERLND 233 SEDMNT SOSED                    TSS    720 SED20    METR      ADD
PERLND 241 SEDMNT SOSED                    TSS    721 SED21    METR      ADD
PERLND 243 SEDMNT SOSED                    TSS    722 SED22    METR      ADD
PERLND 244 SEDMNT SOSED                    TSS    723 SED23    METR      ADD
PERLND 249 SEDMNT SOSED                    TSS    724 SED24    METR      ADD
PERLND 614 SEDMNT SOSED                    TSS    725 SED25    METR      ADD
PERLND 623 SEDMNT SOSED                    TSS    726 SED26    METR      ADD
PERLND 624 SEDMNT SOSED                    TSS    727 SED27    METR      ADD
PERLND 625 SEDMNT SOSED                    TSS    728 SED28    METR      ADD
PERLND 643 SEDMNT SOSED                    TSS    729 SED29    METR      ADD
PERLND 644 SEDMNT SOSED                    TSS    730 SED30    METR      ADD
PERLND 645 SEDMNT SOSED                    TSS    731 SED31    METR      ADD
PERLND 743 SEDMNT SOSED                    TSS    732 SED32    METR      ADD
PERLND 744 SEDMNT SOSED                    TSS    733 SED33    METR      ADD
***  PHOSPHORUS LOSSES
PERLND 116 PHOS   SOSEDP 1 1               TSS    901 TPO01    METR      ADD
PERLND 116 PHOS   TSP4S  1 1            TSS    902 TPO02    METR      ADD
  RLND 116 PHOS   TSP4S  5 1            TSS    903 TPO03    METR      ADD
  RLND 116 PHOS   SSP4S  3 1            TSS    904 TPO04    METR      ADD
  RLND 121 PHOS   POPHOS          ***   TSS    902 TPO02    METR      ADD
  RLND 122 PHOS   POPHOS          ***   TSS    903 TPO03    METR      ADD
PERLND 123 PHOS   POPHOS          ***   TSS    904 TPO04    METR      ADD
PERLND 124 PHOS   POPHOS                TSS    905 TPO05    METR      ADD
PERLND 126 PHOS   POPHOS                TSS    906 TPO06    METR      ADD
  RLND 129 PHOS   POPHOS                TSS    907 TPO07    METR      ADD
  RLND 131 PHOS   POPHOS                TSS    908 TPO08    METR      ADD
  RLND 133 PHOS   POPHOS                TSS    909 TPO09    METR      ADD
 ERLND 140 PHOS   POPHOS                TSS    910 TPO10    METR      ADD
PERLND 141 PHOS   POPHOS                TSS    911 TPO11    METR      ADD
PERLND 142 PHOS   POPHOS                TSS    912 TPO12    METR      ADD
 ERLND 143 PHOS   POPHOS                TSS    913 TPO13    METR      ADD
 ERLND 144 PHOS   POPHOS                TSS    914 TPO14    METR      ADD
 ERLND 146 PHOS   POPHOS                TSS    915 TPO15    METR      ADD
 ERLND 149 PHOS   POPHOS                TSS    916 TPO16    METR      ADD
PERLND 213 PHOS   POPHOS                TSS    917 TPO17    METR      ADD
PERLND 224 PHOS   POPHOS                TSS    918 TPO18    METR      ADD
PERLND 226 PHOS   POPHOS                TSS    919 TPO19    METR      ADD
 ERLND 233 PHOS   POPHOS                TSS    920 TPO20    METR      ADD
 ERLND 241 PHOS   POPHOS                TSS    921 TPO21    METR      ADD
 ERLND 243 PHOS   POPHOS                TSS    922 TPO22    METR      ADD
 ERLND 244 PHOS   POPHOS                TSS    923 TPO23    METR      ADD
PERLND 249 PHOS   POPHOS                TSS    924 TPO24    METR      ADD
PERLND 614 PHOS   POPHOS                TSS    925 TPO25    METR      ADD
 ERLND 623 PHOS   POPHOS                TSS    926 TPO26    METR      ADD
 ERLND 624 PHOS   POPHOS                TSS    927 TPO27    METR      ADD
 ERLND 625 PHOS   POPHOS                TSS    928 TPO28    METR      ADD
 ERLND 643 PHOS   POPHOS                TSS    929 TPO29    METR      ADD
PERLND 644 PHOS   POPHOS                TSS    930 TPO30    METR      ADD
PERLND 645 PHOS   POPHOS                TSS    931 TPO31    METR      ADD
PERLND 743 PHOS   POPHOS                TSS    932 TPO32    METR      ADD
 ERLND 744 PHOS   POPHOS                TSS    933 TPO33    METR      ADD
 ND EXT TARGETS
 ND RUN
END OF DATA
```
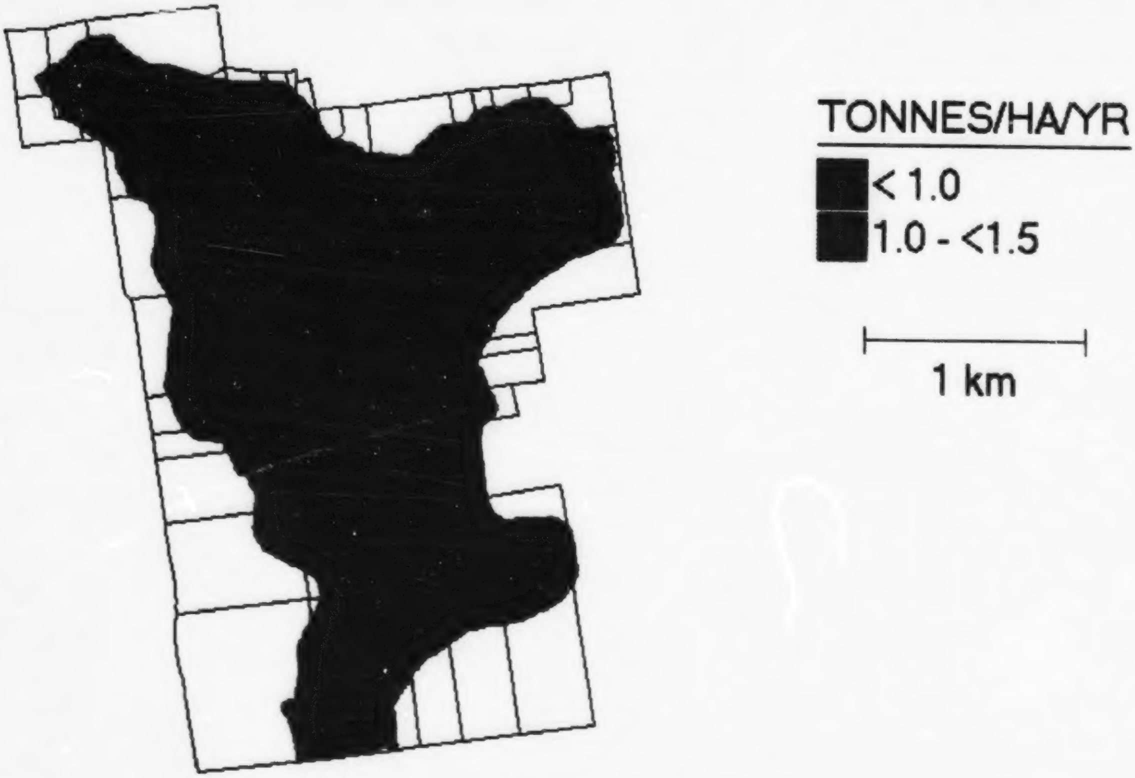
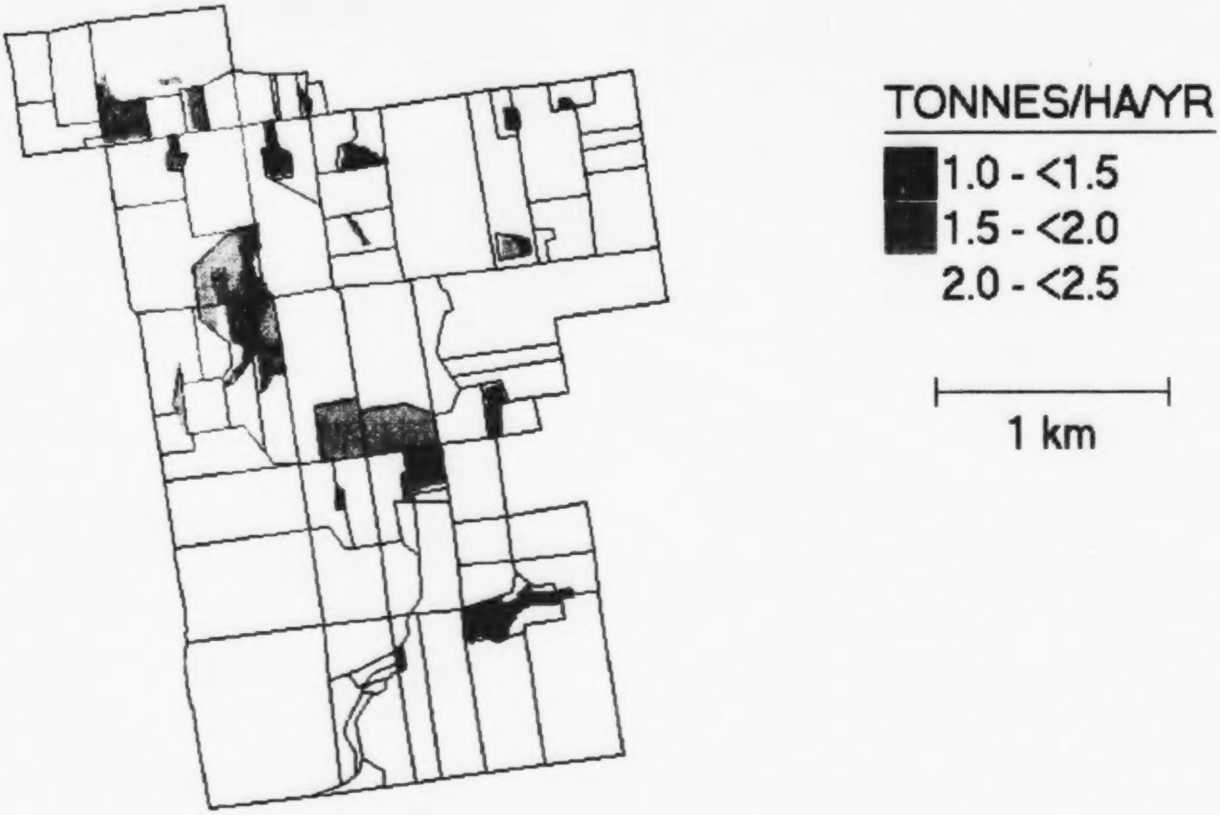

APPENDIX C

Output Maps and Files

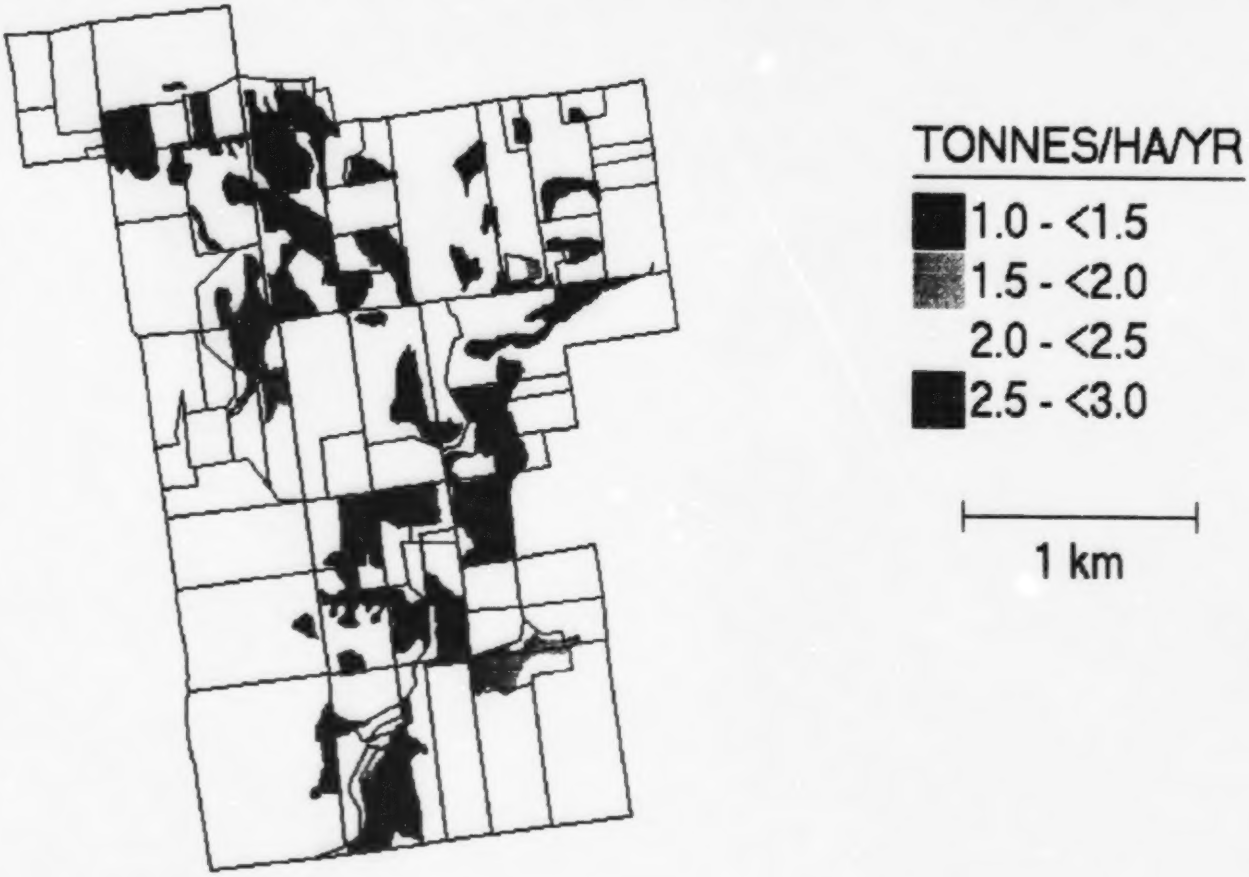
Pasture and Woodland - 1989 Erosion


TONNES/HA/YR
■ < 1.0
■ 1.0 - <1.5
1 km

No Till - 1989 Erosion


TONNES/HA/YR
1.0 - <1.5
1.5 - <2.0
2.0 - <2.5
1 km

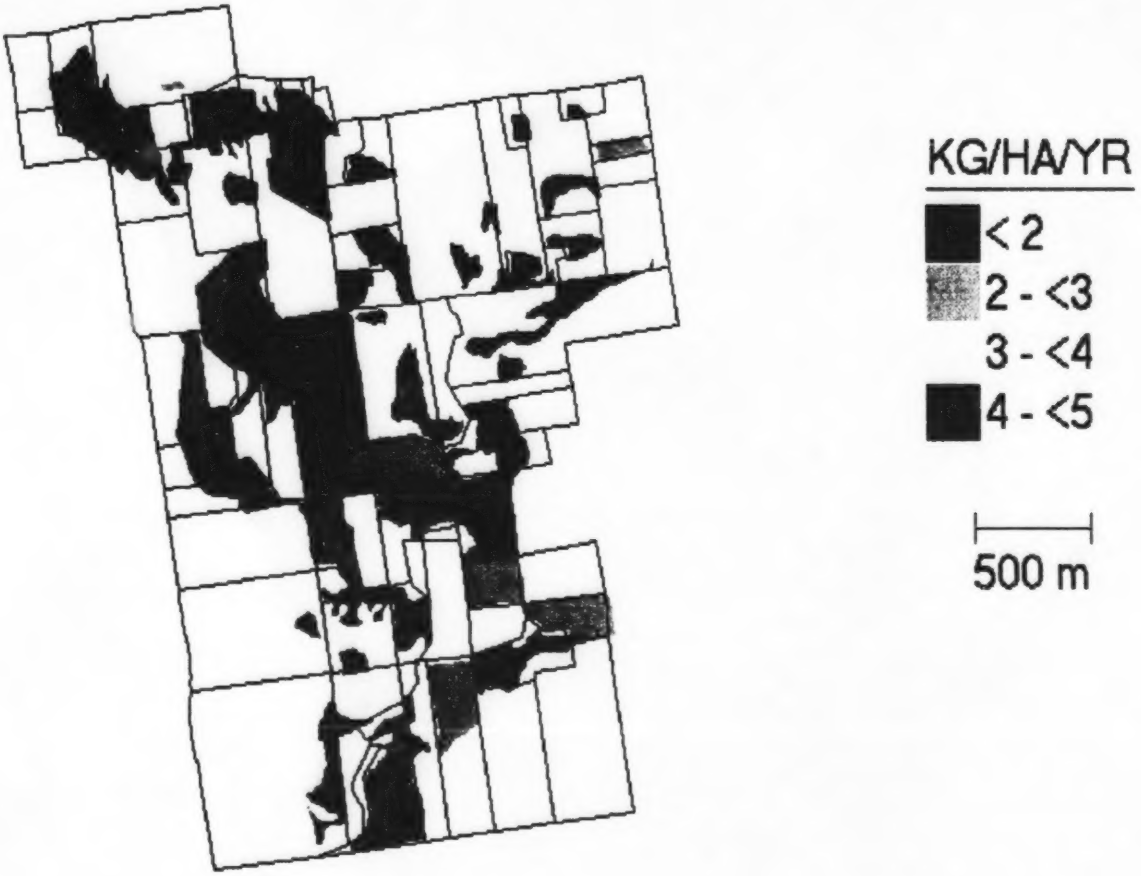
No Implementation - 1989 Erosion


TONNES/HA/YR
1.0 - <1.5
1.5 - <2.0
2.0 - <2.5
2.5 - <3.0
1 km

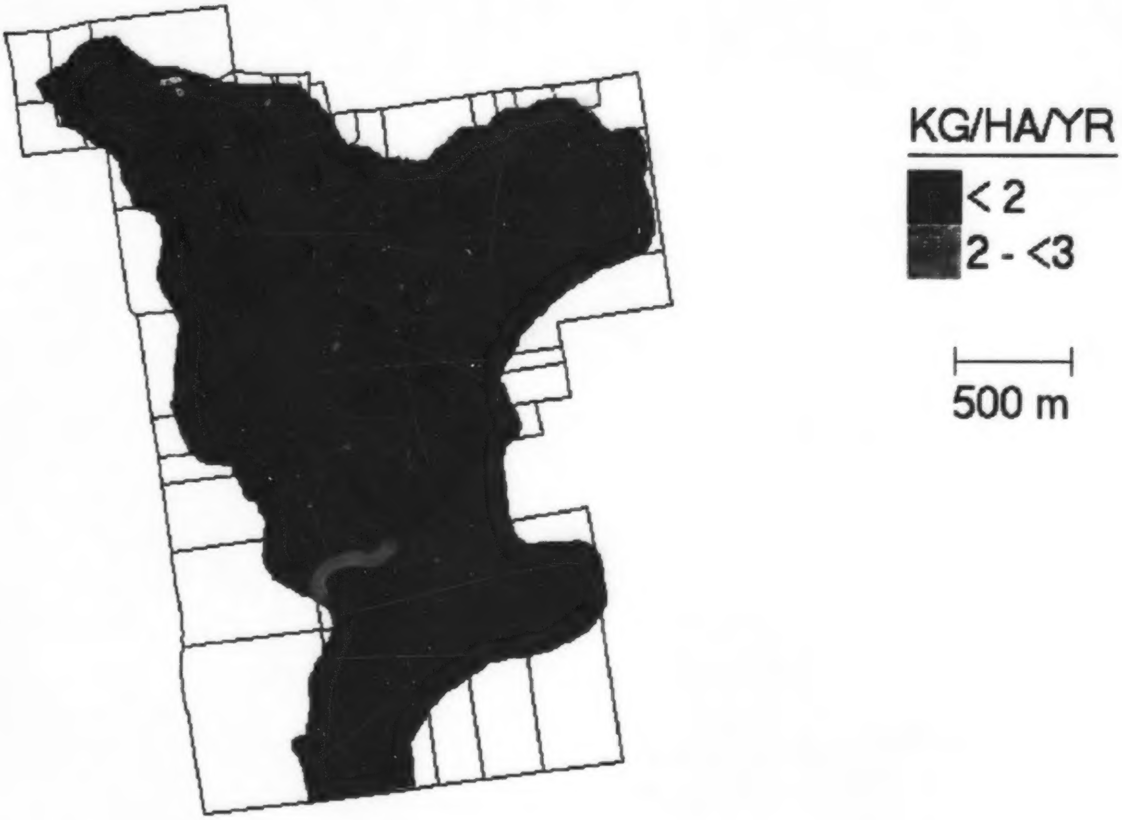
Existing Case - 1989 Erosion

TONNES/HA/YR
1.0 - <1.5
1.5 - <2.0
2.0 - <2.5
1 km

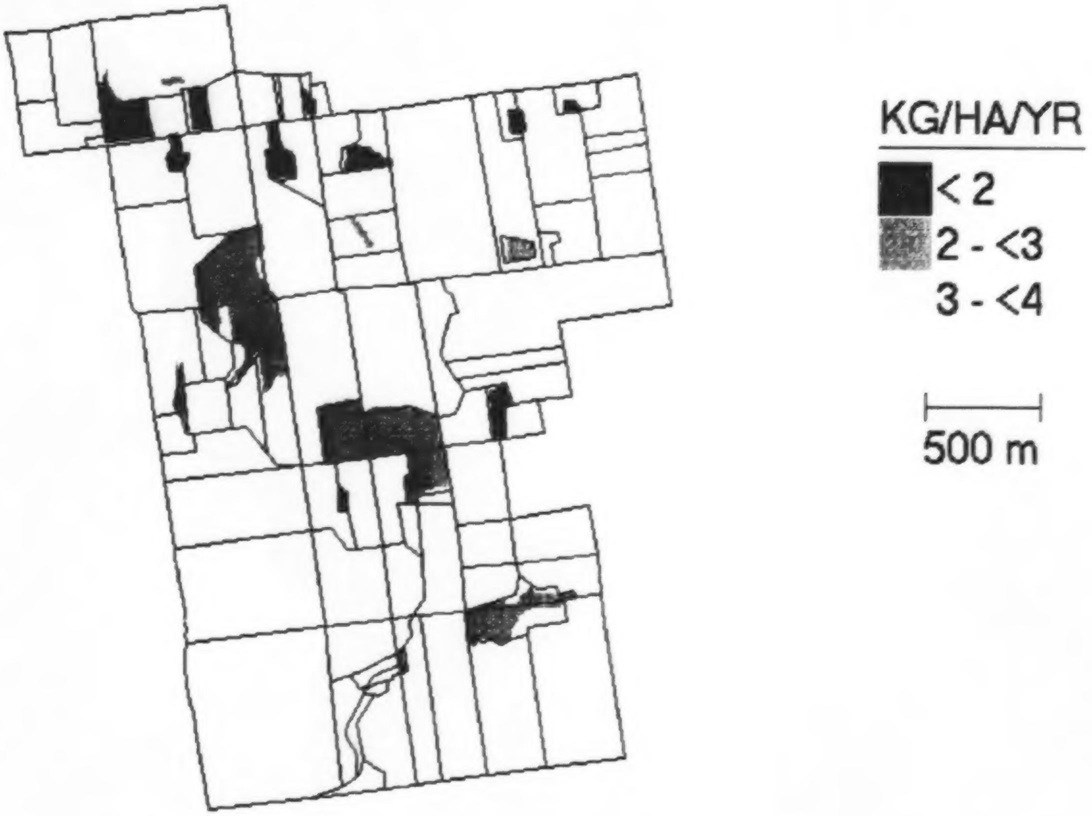
Existing Case - 1989 Phosphorus Loss


KG/HA/YR
< 2
2 - <3
3 - <4
4 - <5
500 m

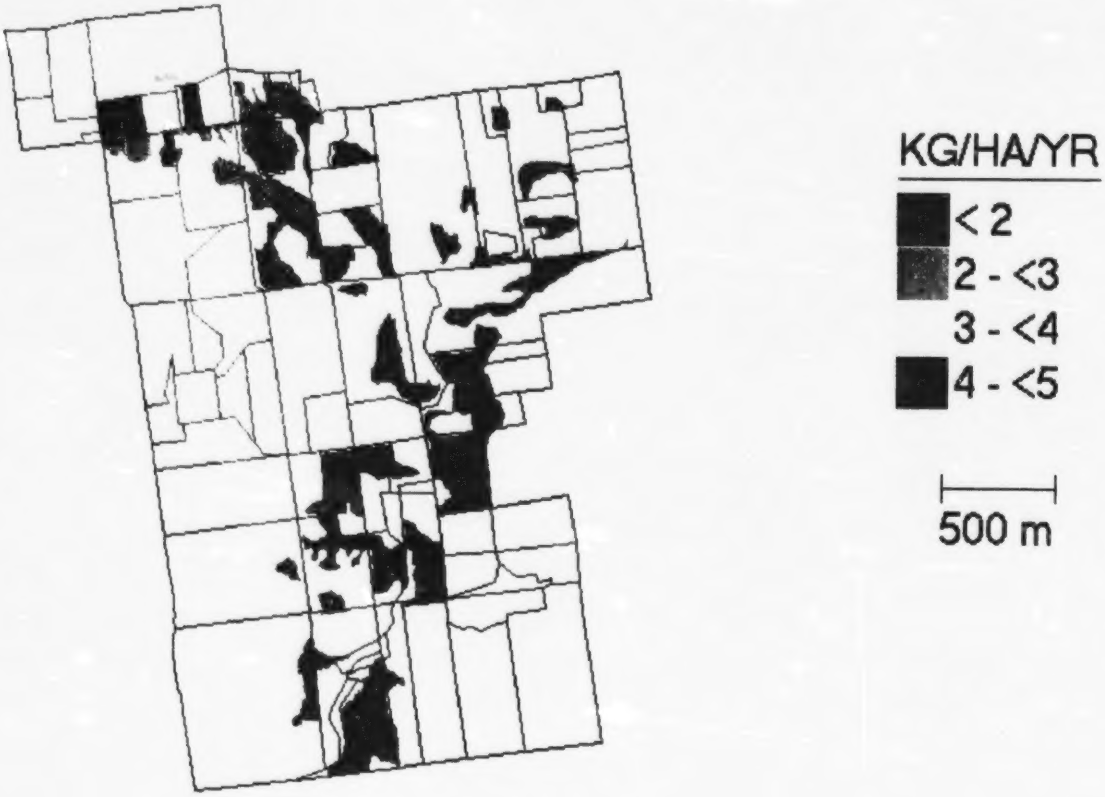
Pasture and Woodland - 1989 Phosphorus Loss


KG/HA/YR
< 2
2 - <3
500 m

No Till - 1989 Phosphorus Loss


KG/HA/YR
< 2
2 - <3
3 - <4
500 m

No Implementation - 1989 Phosphorus Loss


KG/HA/YR
< 2
2 - <3
3 - <4
4 - <5
500 m

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                              Existing Test Flow, (M^3/S)

                     Annual data display: Summary for period ending 1989/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1      0.007    0.063    0.000    0.026    0.003    0.011    0.000    0.000    0.000    0.000    0.000    0.005
    2      0.005    0.016    0.000    0.024    0.003    0.063    0.000    0.000    0.000    0.000    0.000    0.005
    3      0.004    0.010    0.000    0.258    0.002    0.018    0.000    0.000    0.000    0.000    0.000    0.004
    4      0.003    0.008    0.058    0.214    0.002    0.016    0.000    0.000    0.000    0.000    0.000    0.003
    5      0.002    0.004    0.096    0.120    0.004    0.006    0.000    0.000    0.000    0.000    0.000    0.003

    6      0.001    0.003    0.005    0.094    0.003    0.007    0.000    0.000    0.000    0.000    0.000    0.002
    7      0.003    0.002    0.001    0.046    0.003    0.005    0.000    0.000    0.000    0.000    0.013    0.002
    8      0.249    0.002    0.001    0.028    0.003    0.003    0.000    0.000    0.000    0.000    0.006    0.001
    9      0.018    0.001    0.005    0.024    0.003    0.002    0.000    0.000    0.000    0.000    0.017    0.001
   10      0.008    0.001    0.015    0.024    0.001    0.002    0.000    0.000    0.000    0.000    0.004    0.002

   11      0.004    0.001    0.019    0.023    0.001    0.001    0.000    0.000    0.000    0.000    0.002    0.001
   12      0.046    0.000    0.009    0.040    0.007    0.001    0.000    0.000    0.000    0.000    0.001    0.001
   13      0.007    0.000    0.004    0.084    0.009    0.002    0.000    0.000    0.000    0.000    0.001    0.001
   14      0.003    0.014    0.007    0.034    0.006    0.001    0.000    0.000    0.000    0.000    0.001    0.001
   15      0.002    0.005    0.026    0.191    0.004    0.001    0.000    0.000    0.000    0.000    0.055    0.000

   16      0.002    0.002    0.007    0.052    0.003    0.001    0.000    0.000    0.000    0.000    0.160    0.000
   17      0.001    0.001    0.006    0.139    0.002    0.002    0.000    0.000    0.000    0.000    0.027    0.000
   18      0.010    0.001    0.463    0.124    0.001    0.003    0.000    0.000    0.000    0.000    0.010    0.000
   19      0.007    0.001    0.057    0.043    0.001    0.015    0.000    0.000    0.000    0.000    0.006    0.000
   20      0.002    0.000    0.030    0.026    0.002    0.019    0.000    0.000    0.000    0.000    0.013    0.000

   21      0.002    0.033    0.018    0.019    0.002    0.008    0.000    0.000    0.000    0.002    0.009    0.000
   22      0.002    0.007    0.016    0.014    0.001    0.048    0.000    0.000    0.000    0.001    0.006    0.000
   23      0.009    0.001    0.041    0.010    0.002    0.008    0.000    0.000    0.000    0.000    0.004    0.000
   24      0.012    0.000    0.050    0.008    0.004    0.007    0.000    0.000    0.000    0.000    0.003    0.000
   25      0.007    0.000    0.099    0.006    0.006    0.004    0.032    0.000    0.000    0.000    0.003    0.000

   26      0.169    0.000    0.085    0.007    0.124    0.003    0.002    0.000    0.000    0.000    0.007    0.000
   27      0.013    0.000    0.090    0.006    0.008    0.002    0.000    0.000    0.000    0.000    0.006    0.000
   28      0.009    0.000    0.180    0.005    0.007    0.001    0.000    0.000    0.000    0.000    0.051    0.000
   29      0.053             0.139    0.004    0.004    0.001    0.000    0.000    0.000    0.000    0.007    0.000
   30      0.091             0.064    0.004    0.019    0.000    0.000    0.000    0.000    0.000    0.007    0.000
   31      0.040             0.039             0.011             0.000    0.000             0.000             0.002
0 AVER     0.026    0.006    0.053    0.057    0.008    0.009    0.001    0.000    0.000    0.000    0.014    0.001

 AVER of monthly values  1.45015E-02



                              Existing Test Flow, (M^3/S)

                     Annual data display: Summary for period ending 1990/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1      0.005    0.015    0.011    0.041    0.005    0.003    0.015    0.005    0.014    0.015    0.010    0.018
    2      0.009    0.076    0.021    0.134    0.004    0.001    0.009    0.003    0.009    0.012    0.009    0.017
    3      0.013    0.047    0.063    0.090    0.003    0.013    0.005    0.002    0.006    0.010    0.009    0.180
    4      0.057    0.032    0.020    0.054    0.005    0.010    0.003    0.001    0.005    0.162    0.009    0.500
    5      0.071    0.024    0.014    0.034    0.008    0.006    0.002    0.003    0.004    0.020    0.700    0.082

    6      0.039    0.027    0.011    0.032    0.005    0.003    0.001    0.002    0.060    0.013    0.407    0.052
    7      0.030    0.062    0.009    0.024    0.005    0.000    0.000    0.001    0.143    0.016    0.084    0.047
    8      0.032    0.505    0.008    0.020    0.003    0.050    0.005    0.000    0.036    0.017    0.060    0.066
    9      0.052    0.986    0.138    0.018    0.003    0.024    0.260    0.000    0.019    0.552    0.060    0.101
   10      0.087    0.198    0.183    0.233    0.003    0.014    0.014    0.000    0.014    0.350    0.094    0.101

   11      0.097    0.074    0.398    0.193    0.003    0.009    0.010    0.000    0.010    0.56[illegible]    0.052    0.044
   12      0.061    0.048    0.432    0.049    0.001    0.007    0.005    0.001    0.007    0.24[illegible]    0.033    0.038
   13      0.040    0.074    0.491    0.035    0.051    0.005    0.004    0.015    0.006    0.096    0.024    0.049
   14      0.032    0.042    0.275    0.037    0.024    0.004    0.090    0.005    0.370    0.030    0.019    0.025
   15      0.029    0.030    0.156    0.042    0.018    0.003    0.023    0.003    0.260    0.019    0.018    0.019

   16      0.034    0.027    0.177    0.031    0.278    0.002    0.015    0.001    0.077    0.016    0.019    0.060
   17      0.464    0.025    0.122    0.038    0.522    0.001    0.011    0.001    0.038    0.018    0.018    0.026
   18      0.993    0.023    0.064    0.028    0.173    0.002    0.007    0.000    0.023    0.640    0.016    0.258
   19      0.165    0.020    0.064    0.023    0.073    0.001    0.005    0.001    0.024    0.054    0.016    0.121
   20      0.076    0.009    0.053    0.039    0.191    0.000    0.010    0.002    0.021    0.028    0.016    0.034

   21      0.040    0.019    0.052    0.112    0.136    0.000    0.006    0.001    0.018    0.025    0.014    0.121
   22      0.035    1.790    0.086    0.038    0.058    0.000    0.005    0.001    0.025    0.029    0.144    0.209
   23      0.032    0.634    0.143    0.026    0.033    0.107    0.005    0.001    0.017    0.025    0.050    0.180
   24      0.139    0.182    0.027    0.021    0.020    0.043    0.004    0.000    0.029    0.021    0.028    0.040
   25      0.284    0.033    0.022    0.017    0.015    0.020    0.003    0.000    0.018    0.019    0.026    0.017

   26      0.177    0.024    0.020    0.014    0.013    0.015    0.002    0.000    0.016    0.017    0.021    0.013
   27      0.080    0.018    0.017    0.011    0.010    0.013    0.001    0.005    0.014    0.015    0.118    0.012
   28      0.100    0.014    0.016    0.009    0.008    0.009    0.001    2.000    0.011    0.014    0.160    0.012
   29      0.044             0.016    0.007    0.009    0.007    0.000    0.304    0.010    0.012    0.045    1.600
   30      0.028             0.038    0.006    0.006    0.028    0.023    0.071    0.014    0.012    0.021    0.720
   31      0.018             0.036             0.005             0.006    0.023             0.011             0.125
0 AVER     0.108    0.181    0.103    0.049    0.055    0.013    0.018    0.079    0.044    0.100    0.077    0.158

 AVER of monthly values  8.19164E-02
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                                   No Till Test Flow (M^3/S)

                      Annual data display: Summary for period ending 1989/12

 Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

   1      0.007   0.054   0.001   0.064   0.002   0.007   0.001   0.000   0.000   0.000   0.000   0.005
   2      0.004   0.016   0.001   0.046   0.002   0.065   0.001   0.000   0.000   0.000   0.000   0.004
   3      0.003   0.008   0.001   0.197   0.002   0.057   0.000   0.000   0.000   0.000   0.000   0.004
   4      0.002   0.004   0.079   0.167   0.001   0.016   0.000   0.000   0.000   0.000   0.000   0.004
   5      0.002   0.003   0.007   0.125   0.004   0.011   0.000   0.000   0.000   0.000   0.000   0.004

   6      0.001   0.002   0.005   0.087   0.005   0.008   0.000   0.000   0.000   0.000   0.003   0.004
   7      0.030   0.001   0.003   0.058   0.004   0.005   0.000   0.000   0.000   0.000   0.021   0.003
   8      0.206   0.001   0.002   0.038   0.007   0.004   0.000   0.000   0.000   0.000   0.014   0.002
   9      0.013   0.000   0.002   0.026   0.006   0.003   0.000   0.000   0.000   0.000   0.027   0.002
  10      0.008   0.000   0.004   0.018   0.004   0.002   0.000   0.000   0.000   0.001   0.010   0.001

  11      0.005   0.002   0.005   0.012   0.003   0.001   0.000   0.000   0.000   0.002   0.007   0.001
  12      0.039   0.000   0.005   0.041   0.007   0.001   0.000   0.000   0.000   0.001   0.005   0.001
  13      0.013   0.011   0.004   0.041   0.009   0.003   0.000   0.000   0.000   0.001   0.003   0.001
  14      0.006   0.012   0.004   0.032   0.007   0.002   0.000   0.000   0.000   0.000   0.003   0.001
  15      0.003   0.003   0.006   0.242   0.005   0.002   0.000   0.000   0.000   0.000   0.140   0.001

  16      0.002   0.001   0.004   0.063   0.004   0.002   0.000   0.000   0.000   0.000   0.143   0.001
  17      0.001   0.001   0.004   0.171   0.003   0.003   0.000   0.000   0.000   0.000   0.055   0.001
  18      0.004   0.001   0.346   0.091   0.002   0.006   0.000   0.000   0.000   0.001   0.034   0.001
  19      0.006   0.001   0.016   0.046   0.001   0.040   0.000   0.000   0.000   0.000   0.022   0.001
  20      0.004   0.001   0.013   0.031   0.002   0.023   0.000   0.000   0.000   0.001   0.015   0.001

  21      0.002   0.028   0.011   0.022   0.002   0.016   0.000   0.000   0.000   0.002   0.010   0.001
  22      0.001   0.003   0.008   0.017   0.001   0.023   0.000   0.000   0.000   0.002   0.007   0.001
  23      0.007   0.002   0.023   0.012   0.002   0.014   0.000   0.000   0.000   0.001   0.005   0.001
  24      0.011   0.001   0.062   0.009   0.003   0.010   0.000   0.000   0.000   0.001   0.004   0.001
  25      0.007   0.001   0.118   0.007   0.017   0.006   0.052   0.000   0.000   0.001   0.003   0.001

  26      0.140   0.001   0.168   0.006   0.273   0.004   0.002   0.000   0.000   0.000   0.003   0.001
  27      0.010   0.001   0.247   0.005   0.024   0.004   0.001   0.000   0.000   0.000   0.021   0.001
  28      0.053   0.001   0.329   0.004   0.016   0.003   0.001   0.000   0.000   0.000   0.032   0.001
  29      0.063           0.267   0.004   0.011   0.002   0.000   0.000   0.000   0.000   0.010   0.001
  30      0.034           0.153   0.003   0.011   0.001   0.000   0.000   0.000   0.000   0.006   0.001
  31      0.120           0.096           0.008           0.000   0.000           0.000           0.209
0 AVER    0.026   0.006   0.064   0.056   0.014   0.011   0.002   0.000   0.000   0.001   0.020   0.008

 AVER of monthly values  1.74701E-02
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                                   No Till Test Flow (M^3/S)

                      Annual data display: Summary for period ending 1990/12

 Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

   1      0.019   0.134   0.039   0.060   0.004   0.005   0.007   0.006   0.007   0.012   0.005   0.011
   2      0.023   0.045   0.134   0.089   0.003   0.004   0.005   0.004   0.004   0.011   0.005   0.010
   3      0.031   0.025   0.053   0.078   0.002   0.010   0.004   0.002   0.003   0.011   0.005   0.331
   4      0.053   0.038   0.042   0.059   0.004   0.011   0.003   0.002   0.002   0.042   0.005   0.046
   5      0.032   0.042   0.038   0.045   0.012   0.009   0.003   0.002   0.002   0.012   1.465   0.023

   6      0.038   0.631   0.035   0.035   0.010   0.007   0.002   0.001   0.199   0.011   0.056   0.017
   7      0.047   0.092   0.032   0.027   0.008   0.006   0.002   0.001   0.355   0.010   0.023   0.014
   8      0.044   0.177   0.034   0.021   0.007   0.068   0.008   0.001   0.020   0.009   0.015   0.020
   9      0.049   0.534   0.051   0.017   0.005   0.021   0.649   0.001   0.015   0.392   0.108   0.032
  10      0.021   0.061   0.327   0.180   0.004   0.016   0.021   0.001   0.012   0.176   0.028   0.038

  11      0.010   0.050   0.431   0.155   0.003   0.012   0.014   0.001   0.010   0.362   0.025   0.042
  12      0.010   0.045   0.575   0.121   0.003   0.009   0.009   0.003   0.009   0.394   0.026   0.044
  13      0.026   0.150   0.612   0.092   0.187   0.007   0.006   0.100   0.008   0.032   0.027   0.043
  14      0.033   0.036   0.380   0.085   0.055   0.005   0.004   0.009   0.492   0.019   0.023   0.044
  15      0.086   0.041   0.328   0.073   0.040   0.004   0.273   0.006   0.064   0.014   0.105   0.069

  16      0.054   0.038   0.349   0.057   0.432   0.003   0.025   0.004   0.033   0.012   0.085   0.065
  17      0.976   0.016   0.096   0.059   0.212   0.002   0.016   0.003   0.019   0.010   0.042   0.051
  18      0.372   0.009   0.073   0.048   0.087   0.002   0.011   0.002   0.017   0.496   0.025   0.179
  19      0.030   0.010   0.062   0.037   0.066   0.002   0.007   0.002   0.018   0.046   0.016   0.046
  20      0.044   0.027   0.054   0.050   0.119   0.002   0.005   0.002   0.015   0.017   0.011   0.037

  21      0.043   0.033   0.041   0.063   0.075   0.001   0.004   0.001   0.019   0.013   0.008   0.257
  22      0.025   1.937   0.099   0.048   0.057   0.002   0.003   0.001   0.016   0.011   0.352   0.111
  23      0.022   0.083   0.123   0.036   0.042   0.014   0.002   0.001   0.014   0.009   0.026   0.056
  24      0.137   0.046   0.100   0.027   0.031   0.021   0.002   0.001   0.014   0.008   0.027   0.033
  25      0.228   0.040   0.084   0.020   0.023   0.017   0.001   0.001   0.013   0.008   0.037   0.022

  26      0.052   0.034   0.071   0.015   0.017   0.014   0.001   0.001   0.012   0.008   0.013   0.016
  27      0.176   0.040   0.062   0.011   0.013   0.016   0.001   0.003   0.012   0.007   0.235   0.012
  28      0.085   0.041   0.055   0.008   0.010   0.013   0.001   2.847   0.011   0.007   0.080   0.010
  29      0.051           0.044   0.006   0.009   0.010   0.001   0.081   0.011   0.006   0.022   1.478
  30      0.044           0.051   0.005   0.009   0.008   0.125   0.023   0.012   0.006   0.015   0.302
  31      0.046           0.046           0.007           0.011   0.016           0.005           0.047
0 AVER    0.094   0.159   0.146   0.054   0.050   0.011   0.039   0.101   0.048   0.070   0.097   0.113

 AVER of monthly values  8.18827E-02
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                              Fallow K.CK.Test Flow(M^3/S)

                    Annual data display: Summary for period ending 1989/12

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1      0.004     0.033     0.001     0.072     0.002     0.005     0.000     0.000     0.000     0.000     0.000     0.003
    2      0.000     0.011     0.001     0.059     0.002     0.050     0.000     0.000     0.000     0.000     0.000     0.003
    3      0.000     0.006     0.001     0.220     0.002     0.047     0.000     0.000     0.000     0.000     0.000     0.003
    4      0.000     0.003     0.084     0.167     0.001     0.012     0.000     0.000     0.000     0.000     0.000     0.003
    5      0.000     0.002     0.006     0.120     0.003     0.008     0.000     0.000     0.000     0.000     0.000     0.003

    6      0.000     0.002     0.006     0.085     0.004     0.005     0.000     0.000     0.000     0.000     0.003     0.003
    7      0.000     0.001     0.004     0.058     0.003     0.004     0.000     0.000     0.000     0.000     0.006     0.002
    8      0.015     0.000     0.004     0.040     0.005     0.003     0.000     0.000     0.000     0.000     0.008     0.001
    9      0.004     0.000     0.004     0.028     0.004     0.002     0.000     0.000     0.000     0.000     0.009     0.001
   10      0.002     0.000     0.005     0.020     0.003     0.001     0.000     0.000     0.000     0.001     0.006     0.001

   11      0.002     0.001     0.007     0.015     0.002     0.001     0.000     0.000     0.000     0.001     0.004     0.001
   12      0.013     0.001     0.007     0.058     0.004     0.001     0.000     0.000     0.000     0.001     0.002     0.001
   13      0.007     0.009     0.007     0.038     0.006     0.002     0.000     0.000     0.000     0.001     0.002     0.000
   14      0.003     0.008     0.007     0.030     0.005     0.002     0.000     0.000     0.000     0.000     0.001     0.000
   15      0.002     0.002     0.009     0.258     0.004     0.001     0.000     0.000     0.000     0.000     0.035     0.000

   16      0.001     0.001     0.007     0.054     0.003     0.001     0.000     0.000     0.000     0.000     0.072     0.000
   17      0.001     0.001     0.023     0.188     0.002     0.002     0.000     0.000     0.000     0.000     0.025     0.000
   18      0.003     0.001     0.413     0.078     0.001     0.005     0.000     0.000     0.000     0.001     0.017     0.000
   19      0.005     0.001     0.017     0.040     0.001     0.009     0.000     0.000     0.000     0.000     0.012     0.000
   20      0.003     0.001     0.015     0.027     0.002     0.013     0.000     0.000     0.000     0.001     0.009     0.000

   21      0.002     0.023     0.013     0.020     0.002     0.008     0.000     0.000     0.000     0.002     0.007     0.000
   22      0.001     0.002     0.010     0.015     0.001     0.015     0.000     0.000     0.000     0.002     0.005     0.000
   23      0.005     0.002     0.026     0.012     0.002     0.008     0.000     0.000     0.000     0.001     0.004     0.000
   24      0.008     0.001     0.069     0.009     0.002     0.006     0.000     0.000     0.000     0.001     0.003     0.000
   25      0.005     0.001     0.132     0.007     0.004     0.004     0.024     0.000     0.000     0.000     0.002     0.000

   26      0.021     0.001     0.179     0.006     0.092     0.002     0.001     0.000     0.000     0.000     0.002     0.000
   27      0.002     0.001     0.264     0.005     0.012     0.002     0.000     0.000     0.000     0.000     0.017     0.000
   28      0.010     0.001     0.330     0.004     0.009     0.001     0.000     0.000     0.000     0.000     0.024     0.000
   29      0.023               0.269     0.003     0.006     0.001     0.000     0.000     0.000     0.000     0.006     0.000
   30      0.015               0.159     0.003     0.012     0.000     0.000     0.000     0.000     0.000     0.004     0.000
   31      0.065               0.102               0.004               0.000     0.000               0.000               0.122
AVER       0.007     0.004     0.070     0.058     0.007     0.007     0.001     0.000     0.000     0.000     0.010     0.005

AVER of monthly values  1.41483E-02
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                              Fallow K.CK.Test Flow(M^3/S)

                    Annual data display: Summary for period ending 1990/12

  Day        JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1      0.009     0.138     0.041     0.093     0.004     0.003     0.006     0.002     0.008     0.010     0.005     0.009
    2      0.014     0.037     0.139     0.116     0.003     0.002     0.005     0.001     0.005     0.010     0.004     0.009
    3      0.018     0.027     0.055     0.089     0.002     0.008     0.004     0.001     0.003     0.009     0.004     0.306
    4      0.034     0.038     0.046     0.069     0.004     0.010     0.003     0.001     0.003     0.032     0.004     0.036
    5      0.023     0.042     0.043     0.055     0.011     0.008     0.002     0.001     0.002     0.010     1.357     0.020

    6      0.028     0.621     0.041     0.043     0.010     0.006     0.002     0.001     0.119     0.009     0.045     0.015
    7      0.034     0.089     0.040     0.035     0.008     0.005     0.001     0.001     0.303     0.009     0.023     0.011
    8      0.034     0.177     0.044     0.028     0.006     0.018     0.001     0.001     0.018     0.008     0.015     0.019
    9      0.037     0.516     0.075     0.023     0.005     0.011     0.268     0.000     0.014     0.309     0.112     0.029
   10      0.014     0.061     0.397     0.192     0.004     0.009     0.016     0.000     0.011     0.172     0.023     0.033

   11      0.007     0.051     0.429     0.146     0.003     0.007     0.010     0.000     0.010     0.327     0.026     0.037
   12      0.008     0.047     0.602     0.117     0.002     0.006     0.007     0.001     0.008     0.381     0.028     0.038
   13      0.022     0.147     0.616     0.091     0.077     0.004     0.004     0.012     0.008     0.028     0.029     0.037
   14      0.028     0.036     0.387     0.085     0.033     0.003     0.003     0.003     0.436     0.017     0.023     0.039
   15      0.072     0.044     0.336     0.073     0.025     0.003     0.141     0.003     0.059     0.013     0.085     0.071

   16      0.045     0.038     0.355     0.057     0.358     0.002     0.017     0.002     0.022     0.010     0.075     0.052
   17      0.932     0.015     0.101     0.055     0.181     0.002     0.011     0.002     0.017     0.009     0.033     0.053
   18      0.346     0.009     0.079     0.047     0.072     0.001     0.007     0.001     0.015     0.496     0.020     0.156
   19      0.030     0.012     0.069     0.037     0.056     0.001     0.005     0.001     0.015     0.047     0.012     0.037
   20      0.043     0.030     0.062     0.050     0.138     0.001     0.006     0.001     0.013     0.016     0.008     0.033

   21      0.040     0.035     0.045     0.062     0.065     0.001     0.003     0.001     0.025     0.012     0.006     0.235
   22      0.025     1.927     0.129     0.048     0.049     0.001     0.002     0.001     0.016     0.009     0.312     0.097
   23      0.022     0.068     0.133     0.037     0.037     0.009     0.002     0.001     0.013     0.008     0.022     0.047
   24      0.130     0.048     0.114     0.028     0.027     0.017     0.001     0.001     0.012     0.007     0.028     0.028
   25      0.221     0.041     0.099     0.021     0.021     0.015     0.001     0.001     0.012     0.007     0.029     0.019

   26      0.049     0.036     0.088     0.016     0.015     0.012     0.001     0.000     0.011     0.006     0.010     0.013
   27      0.175     0.042     0.078     0.012     0.012     0.014     0.001     0.001     0.010     0.006     0.209     0.010
   28      0.076     0.042     0.071     0.009     0.009     0.012     0.001     2.295     0.010     0.006     0.069     0.008
   29      0.050               0.059     0.007     0.007     0.009     0.000     0.077     0.009     0.006     0.019     1.406
   30      0.044               0.073     0.005     0.005     0.007     0.026     0.025     0.010     0.005     0.012     0.266
   31      0.046               0.061               0.004               0.003     0.019               0.005               0.044
0 AVER     0.086     0.158     0.158     0.058     0.040     0.007     0.018     0.079     0.041     0.065     0.088     0.104

AVER of monthly values  7.51218E-02
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                          Existing Test Soil Loss(T/d)

                Annual data display: Summary for period ending 1989/12

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1      0.010   0.270   0.000   0.072   0.003   0.035   0.000   0.000   0.000   0.000   0.000   0.007
  2      0.007   0.035   0.000   0.062   0.003   1.550   0.000   0.000   0.000   0.000   0.000   0.007
  3      0.004   0.018   0.000   2.251   0.002   0.136   0.000   0.000   0.000   0.000   0.000   0.004
  4      0.002   0.013   0.439   1.655   0.001   0.099   0.000   0.000   0.000   0.000   0.000   0.003
  5      0.002   0.005   0.589   0.684   0.005   0.012   0.000   0.000   0.000   0.000   0.000   0.003

  6      0.001   0.003   0.007   0.481   0.004   0.013   0.000   0.000   0.000   0.000   0.000   0.001
  7      0.002   0.002   0.001   0.166   0.004   0.007   0.000   0.000   0.000   0.000   0.081   0.001
  8      2.463   0.001   0.001   0.078   0.004   0.004   0.000   0.000   0.000   0.000   0.009   0.001
  9      0.043   0.000   0.008   0.064   0.002   0.001   0.000   0.000   0.000   0.000   0.070   0.001
 10      0.013   0.000   0.030   0.061   0.001   0.001   0.000   0.000   0.000   0.000   0.005   0.001

 11      0.004   0.001   0.046   0.060   0.001   0.001   0.000   0.000   0.000   0.000   0.001   0.000
 12      0.207   0.000   0.014   0.166   0.023   0.001   0.000   0.000   0.000   0.000   0.001   0.000
 13      0.011   0.000   0.004   0.409   0.023   0.001   0.000   0.000   0.000   0.000   0.000   0.000
 14      0.003   0.038   0.012   0.106   0.010   0.001   0.000   0.000   0.000   0.000   0.000   0.000
 15      0.002   0.007   0.075   1.499   0.006   0.000   0.000   0.000   0.000   0.000   0.909   0.000

 16      0.001   0.001   0.011   0.198   0.003   0.000   0.000   0.000   0.000   0.000   3.813   0.000
 17      0.001   0.001   0.008   1.077   0.002   0.001   0.000   0.000   0.000   0.000   0.133   0.000
 18      0.026   0.001   5.375   0.750   0.001   0.003   0.000   0.000   0.000   0.000   0.023   0.000
 19      0.011   0.000   0.225   0.147   0.000   0.263   0.000   0.000   0.000   0.000   0.009   0.000
 20      0.002   0.000   0.087   0.071   0.002   0.162   0.000   0.000   0.000   0.000   0.040   0.000

 21      0.002   0.152   0.041   0.044   0.002   0.019   0.000   0.000   0.000   0.002   0.019   0.000
 22      0.002   0.013   0.034   0.028   0.000   1.054   0.000   0.000   0.000   0.001   0.008   0.000
 23      0.021   0.001   0.138   0.017   0.002   0.019   0.000   0.000   0.000   0.000   0.004   0.000
 24      0.025   0.000   0.202   0.012   0.005   0.017   0.000   0.000   0.000   0.000   0.002   0.000
 25      0.010   0.000   0.528   0.009   0.039   0.006   1.094   0.000   0.000   0.000   0.003   0.000

 26      1.370   0.000   0.414   0.009   4.395   0.002   0.002   0.000   0.000   0.000   0.012   0.000
 27      0.027   0.000   0.455   0.008   0.020   0.001   0.000   0.000   0.000   0.000   0.008   0.000
 28      0.015   0.000   1.239   0.006   0.013   0.001   0.000   0.000   0.000   0.000   0.446   0.000
 29      0.199           0.875   0.005   0.007   0.000   0.000   0.000   0.000   0.000   0.011   0.000
 30      0.450           0.270   0.004   0.178   0.000   0.000   0.000   0.000   0.000   0.012   0.000
 31      0.145           0.128           0.035           0.000   0.000           0.000           0.002
0 SUM    5.081   0.562  11.256  10.199   4.796   3.410   1.096   0.000   0.000   0.003   5.619   0.031

 SUM  of monthly values  4.20530E+01



                          Existing Test Soil Loss(T/d)

                Annual data display: Summary for period ending 1990/12

Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

  1      0.019   0.102   0.063   0.487   0.016   0.009   0.084   0.018   0.080   0.082   0.070   0.150
  2      0.046   1.237   0.171   3.483   0.012   0.002   0.040   0.008   0.040   0.062   0.064   0.138
  3      0.082   0.591   0.927   1.633   0.010   0.069   0.021   0.004   0.021   0.047   0.062   3.111
  4      0.795   0.327   0.159   0.732   0.022   0.048   0.009   0.002   0.017   2.861   0.059  11.905
  5      1.114   0.210   0.092   0.355   0.035   0.023   0.004   0.009   0.011   0.127  18.521   1.127

  6      0.443   0.252   0.063   0.320   0.019   0.008   0.001   0.004   0.587   0.070  10.039   0.611
  7      0.296   0.904   0.046   0.210   0.016   0.000   0.000   0.001   1.979   0.094   1.160   0.537
  8      0.327  22.759   0.039   0.161   0.011   0.600   0.065   0.000   0.295   0.102   0.743   0.858
  9      0.690  63.685   3.095   0.134   0.007   0.161   6.642   0.000   0.121  13.102   0.768   1.544
 10      1.522   5.393   4.777  10.693   0.008   0.075   0.076   0.000   0.080   6.925   1.354   1.464

 11      1.800   1.187  15.780   5.903   0.007   0.042   0.045   0.000   0.050  14.042   0.608   0.485
 12      0.882   0.610  17.901   0.639   0.003   0.028   0.020   0.001   0.031   5.305   0.336   0.402
 13      0.461   1.187  21.796   0.383   0.579   0.018   0.011   0.097   0.023   1.245   0.216   0.571
 14      0.327   0.497   8.937   0.406   0.163   0.013   1.035   0.020   7.485   0.224   0.165   0.238
 15      0.281   0.296   3.737   0.505   0.109   0.008   0.167   0.008   4.568   0.118   0.146   0.159

 16      0.359   0.252   4.539   0.311   5.017   0.004   0.081   0.003   0.844   0.091   0.162   0.741
 17     19.980   0.224   2.561   0.433  12.117   0.002   0.052   0.002   0.313   0.113   0.153   0.263
 18     64.382   0.197   0.949   0.268   2.583   0.005   0.029   0.001   0.153  16.116   0.132   5.076
 19      4.074   0.159   0.949   0.192   0.772   0.001   0.016   0.004   0.163   0.519   0.134   1.944
 20      1.237   0.046   0.710   0.561   2.967   0.000   0.050   0.005   0.135   0.201   0.130   0.347

 21      0.461   0.147   0.690   2.446   1.845   0.000   0.021   0.002   0.106   0.174   0.105   2.292
 22      0.375 159.338   1.496   0.437   0.560   0.000   0.018   0.002   0.177   0.214   2.690   3.843
 23      0.327  32.291   3.269   0.243   0.254   2.148   0.020   0.002   0.105   0.176   0.578   3.111
 24      3.130   4.737   0.253   0.170   0.126 [illegible] 0.013   0.000   0.211   0.139   0.273   0.431
 25      9.391   0.343   0.187   0.125   0.084   0.128   0.007   0.000   0.111   0.117   0.250   0.140

 26      4.539   0.210   0.159   0.095   0.069   0.083   0.004   0.000   0.096   0.097   0.187   0.099
 27      1.338   0.135   0.125   0.062   0.048   0.072   0.002   0.058   0.075   0.083   1.828   0.089
 28      1.886   0.092   0.115   0.045   0.035   0.042   0.001  79.395   0.054   0.074   2.665   0.089
 29      0.534           0.109   0.030   0.041   0.030   0.000   5.686   0.046   0.064   0.509  54.859
 30      0.266           0.451   0.022   0.023   0.301   0.249   0.746   0.074   0.061   0.190  19.220
 31      0.135           0.392           0.018           0.024   0.151           0.055           1.927
0 SUM  121.499 297.408  94.537  31.484  27.576   4.355   8.807  86.229  18.051  62.700  44.297 117.771

 SUM  of monthly values  9.14714E+02
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                                   No Till Test Soil Loss (T/d)

                          Annual data display: Summary for period ending 1989/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1      0.018    0.167    0.000    0.138    0.000    0.059    0.000    0.000    0.000    0.000    0.000    0.003
    2      0.001    0.027    0.000    0.083    0.000    3.044    0.000    0.000    0.000    0.000    0.000    0.002
    3      0.001    0.015    0.000    0.821    0.000    1.477    0.000    0.000    0.000    0.000    0.000    0.001
    4      0.001    0.007    0.395    0.448    0.000    0.210    0.000    0.000    0.000    0.000    0.000    0.001
    5      0.001    0.005    0.009    0.489    0.000    0.126    0.000    0.000    0.000    0.000    0.000    0.000

    6      0.001    0.003    0.004    0.222    0.000    0.080    0.000    0.000    0.000    0.000    0.000    0.000
    7      0.151    0.001    0.002    0.130    0.000    0.050    0.000    0.000    0.000    0.000    0.175    0.000
    8      1.330    0.000    0.001    0.068    0.002    0.031    0.000    0.000    0.000    0.000    0.009    0.000
    9      0.044    0.000    0.001    0.033    0.000    0.016    0.000    0.000    0.000    0.000    0.209    0.000
   10      0.025    0.000    0.000    0.020    0.000    0.007    0.000    0.000    0.000    0.000    0.005    0.000

   11      0.013    0.001    0.000    0.013    0.000    0.003    0.000    0.000    0.000    0.000    0.003    0.000
   12      0.251    0.000    0.000    0.370    0.001    0.001    0.000    0.000    0.000    0.000    0.000    0.000
   13      0.022    0.027    0.000    0.088    0.004    0.001    0.000    0.000    0.000    0.000    0.000    0.000
   14      0.012    0.012    0.000    0.049    0.002    0.000    0.000    0.000    0.000    0.000    0.000    0.000
   15      0.006    0.001    0.001    2.954    0.000    0.000    0.000    0.000    0.000    0.000    1.777    0.000

   16      0.003    0.000    0.000    0.216    0.000    0.000    0.000    0.000    0.000    0.000    0.830    0.000
   17      0.001    0.000    0.000    1.843    0.000    0.000    0.000    0.000    0.000    0.000    0.155    0.000
   18      0.002    0.000    2.554    0.320    0.000    0.002    0.000    0.000    0.000    0.000    0.078    0.000
   19      0.002    0.000    0.058    0.153    0.000    1.107    0.000    0.000    0.000    0.000    0.042    0.000
   20      0.000    0.000    0.037    0.082    0.000    0.080    0.000    0.000    0.000    0.000    0.027    0.000

   21      0.000    0.104    0.024    0.049    0.000    0.024    0.000    0.000    0.000    0.000    0.017    0.000
   22      0.000    0.001    0.016    0.032    0.000    0.074    0.000    0.000    0.000    0.000    0.011    0.000
   23      0.003    0.000    0.036    0.022    0.000    0.019    0.000    0.000    0.000    0.000    0.006    0.000
   24      0.005    0.000    0.142    0.015    0.000    0.013    0.000    0.000    0.000    0.000    0.004    0.000
   25      0.002    0.000    0.291    0.010    0.019    0.008    5.173    0.000    0.000    0.000    0.002    0.000

   26      0.883    0.000    0.422    0.007   18.648    0.004    0.071    0.000    0.000    0.000    0.001    0.000
   27      0.022    0.000    0.610    0.004    0.503    0.002    0.032    0.000    0.000    0.000    0.213    0.000
   28      0.191    0.000    0.797    0.002    0.299    0.001    0.012    0.000    0.000    0.000    0.315    0.000
   29      0.277             0.651    0.001    0.179    0.001    0.004    0.000    0.000    0.000    0.012    0.000
   30      0.069             0.375    0.001    0.123    0.000    0.001    0.000    0.000    0.000    0.007    0.000
   31      0.438             0.228             0.079             0.001    0.000             0.000             2.308
0 SUM      3.776    0.371    6.654    8.683   19.862    6.442    5.294    0.001    0.000    0.000    3.896    2.317

  SUM  of monthly values  5.72955E+01


                                   No Till Test Soil Loss (T/d)

                          Annual data display: Summary for period ending 1990/12

  Day        JAN      FEB      MAR      APR      MAY      JUN      JUL      AUG      SEP      OCT      NOV      DEC

    1      0.132    5.136    0.605    0.710    0.002    0.007    0.003    0.042    0.038    0.015    0.002    0.060
    2      0.508    1.291    4.461    1.142    0.001    0.004    0.001    0.023    0.021    0.014    0.001    0.041
    3      0.813    0.770    0.912    0.234    0.000    0.022    0.000    0.013    0.012    0.013    0.001    6.311
    4      1.850    1.152    0.551    0.160    0.016    0.009    0.000    0.019    0.006    0.253    0.000    0.414
    5      0.585    1.266    0.465    0.107    0.012    0.007    0.000    0.058    0.003    0.020   37.705    0.168

    6      0.648   20.867    0.390    0.068    0.005    0.006    0.000    0.001    3.642    0.015    1.003    0.103
    7      1.037    3.265    0.344    0.042    0.004    0.002    0.000    0.000    4.681    0.012    0.269    0.066
    8      0.836    6.709    0.360    0.028    0.003    4.970    0.002    0.000    0.136    0.010    0.158    0.056
    9      1.095   19.384    1.117    0.020    0.000    0.124   27.678    0.000    0.082    6.010    0.846    0.071
   10      0.123    1.922   10.397    5.092    0.000    0.088    0.359    0.000    0.051    1.342    0.204    0.083

   11      0.073    1.441   14.364    0.567    0.000    0.063    0.210    0.029    0.034    5.829    0.122    0.091
   12      0.167    1.235   19.857    0.411    0.000    0.046    0.125    0.133    0.025    5.156    0.094    0.091
   13      0.558    5.626   21.634    0.290    7.958    0.033    0.074    2.981    0.019    0.225    0.081    0.084
   14      0.689    0.830   13.146    0.370    0.342    0.021    0.045    0.070   12.973    0.115    0.064    0.082
   15      2.999    1.050   11.127    0.191    0.222    0.013    8.455    0.039    0.738    0.070    0.245    0.302

   16      1.503    0.821   11.202    0.151   18.725    0.007    0.396    0.023    0.261    0.045    0.280    0.396
   17     34.440    0.171    1.694    0.227    5.936    0.003    0.254    0.013    0.126    0.031    0.097    0.183
   18     12.144    0.104    0.768    0.098    0.590    0.002    0.135    0.006    0.082    9.209    0.046    1.034
   19      0.759    0.203    0.618    0.063    0.404    0.001    0.080    0.059    0.063    0.345    0.028    0.110
   20      1.213    0.589    0.511    0.912    3.148    0.000    0.130    0.002    0.046    0.131    0.018    0.075

   21      1.120    0.676    0.261    0.225    0.408    0.000    0.031    0.001    0.060    0.079    0.012    2.105
   22      0.518   63.596    2.222    0.103    0.274    0.001    0.095    0.000    0.042    0.050    3.245    0.475
   23      0.497    2.164    0.637    0.066    0.180    0.223    0.011    0.000    0.031    0.034    0.107    0.149
   24      5.564    0.934    0.378    0.041    0.116    0.021    0.009    0.000    0.027    0.026    0.117    0.075
   25      8.208    0.673    0.309    0.027    0.076    0.011    0.002    0.000    0.024    0.020    0.180    0.043

   26      1.535    0.548    0.231    0.019    0.052    0.014    0.001    0.000    0.021    0.016    0.035    0.028
   27      6.736    0.702    0.184    0.013    0.037    0.015    0.000    0.012    0.019    0.013    6.253    0.019
   28      3.044    0.638    0.150    0.010    0.026    0.008    0.000   49.512    0.017    0.010    0.578    0.014
   29      1.605             0.103    0.006    0.021    0.006    0.000    0.850    0.015    0.007    0.163   26.208
   30      1.287             0.232    0.003    0.017    0.005    2.505    0.111    0.016    0.004    0.098    2.945
   31      1.432             0.104             0.013             0.087    0.068             0.002             0.185
0 SUM     93.716  143.766  119.335   11.393   38.587    5.734   40.686   54.066   23.312   29.121   52.048   42.066

  SUM  of monthly values  6.53831E+02
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                          Fallow K.CK. Soil Loss (T/d)

               Annual data display: Summary for period ending 1989/12

  Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1      0.018   0.078   0.000   0.161   0.001   0.011   0.000   0.000   0.000   0.000   0.000   0.006
    2      0.001   0.009   0.000   0.172   0.000   3.332   0.000   0.000   0.000   0.000   0.000   0.003
    3      0.001   0.004   0.000   1.637   0.000   2.386   0.000   0.000   0.000   0.000   0.000   0.002
    4      0.001   0.002   0.728   0.547   0.000   0.159   0.000   0.000   0.000   0.000   0.000   0.001
    5      0.001   0.001   0.016   0.474   0.000   0.087   0.000   0.000   0.000   0.000   0.000   0.001

    6      0.001   0.001   0.011   0.228   0.000   0.053   0.000   0.000   0.000   0.000   0.000   0.000
    7      0.001   0.000   0.006   0.138   0.000   0.033   0.000   0.000   0.000   0.000   0.002   0.000
    8      0.027   0.000   0.005   0.077   0.000   0.017   0.000   0.000   0.000   0.000   0.003   0.000
    9      0.001   0.000   0.003   0.040   0.000   0.008   0.000   0.000   0.000   0.000   0.005   0.000
   10      0.001   0.000   0.002   0.024   0.000   0.003   0.000   0.000   0.000   0.000   0.001   0.000

   11      0.001   0.001   0.004   0.016   0.000   0.001   0.000   0.000   0.000   0.000   0.000   0.000
   12      0.034   0.000   0.003   1.354   0.001   0.001   0.000   0.000   0.000   0.000   0.000   0.000
   13      0.003   0.037   0.003   0.118   0.001   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   14      0.001   0.007   0.003   0.065   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   15      0.001   0.000   0.004   8.291   0.000   0.000   0.000   0.000   0.000   0.000   0.465   0.000

   16      0.001   0.000   0.003   0.352   0.000   0.000   0.000   0.000   0.000   0.000   1.141   0.000
   17      0.001   0.000   0.023   5.472   0.000   0.000   0.000   0.000   0.000   0.000   0.046   0.000
   18      0.001   0.000   5.098   0.510   0.000   0.000   0.000   0.000   0.000   0.000   0.029   0.000
   19      0.001   0.000   0.101   0.271   0.000   0.028   0.000   0.000   0.000   0.000   0.021   0.000
   20      0.001   0.000   0.064   0.158   0.000   0.012   0.000   0.000   0.000   0.000   0.015   0.000

   21      0.001   0.126   0.043   0.101   0.000   0.004   0.000   0.000   0.000   0.000   0.010   0.000
   22      0.001   0.001   0.030   0.067   0.000   0.061   0.000   0.000   0.000   0.000   0.005   0.000
   23      0.003   0.000   0.051   0.046   0.000   0.004   0.000   0.000   0.000   0.000   0.003   0.000
   24      0.004   0.000   0.170   0.032   0.000   0.001   0.000   0.000   0.000   0.000   0.002   0.000
   25      0.001   0.000   0.350   0.023   0.001   0.000   1.874   0.000   0.000   0.000   0.001   0.000

   26      0.173   0.000   0.461   0.014   2.783   0.000   0.008   0.000   0.000   0.000   0.000   0.000
   27      0.000   0.000   0.681   0.009   0.062   0.000   0.001   0.000   0.000   0.000   0.615   0.000
   28      0.016   0.000   0.811   0.005   0.039   0.000   0.000   0.000   0.000   0.000   0.861   0.000
   29      0.129           0.660   0.003   0.024   0.000   0.000   0.000   0.000   0.000   0.019   0.000
   30      0.013           0.389   0.001   0.086   0.000   0.000   0.000   0.000   0.000   0.011   0.000
   31      0.205           0.246           0.014           0.000   0.000           0.000           1.535
0 SUM      0.641   0.269   9.969  20.406   3.013   6.203   1.884   0.000   0.000   0.000   3.257   1.548

SUM  of monthly values  4.71885E+01


                          Fallow K.CK. Soil Loss (T/d)

               Annual data display: Summary for period ending 1990/12

  Day        JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1      0.090   7.156   1.182   2.493   0.003   0.010   0.001   0.005   0.486   0.020   0.001   0.136
    2      0.477   1.253   6.662   2.856   0.001   0.005   0.000   0.002   0.279   0.018   0.001   0.089
    3      0.708   1.154   1.594   0.384   0.001   0.027   0.000   0.001   0.165   0.016   0.000   8.399
    4      1.661   1.563   1.186   0.266   0.051   0.008   0.000   0.013   0.089   0.138   0.000   0.586
    5      0.665   1.712   1.120   0.187   0.011   0.006   0.000   0.056   0.042   0.022  71.970   0.274

    6      0.781  29.320   1.017   0.128   0.005   0.004   0.000   0.000   2.227   0.016   2.197   0.164
    7      1.169   4.313   0.975   0.086   0.004   0.001   0.000   0.000   6.486   0.013   0.662   0.102
    8      1.013   9.258   1.002   0.058   0.002   0.639   0.002   0.000   0.254   0.011   0.387   0.083
    9      1.212  26.425   3.006   0.039   0.000   0.014  38.484   0.000   0.149   5.029   1.133   0.094
   10      0.121   2.567  18.292   8.815   0.000   0.012   0.989   0.000   0.091   1.698   0.394   0.099

   11      0.073   2.024  20.410   0.792   0.000   0.009   0.564   0.016   0.060   6.911   0.258   0.110
   12      0.234   1.826  29.140   0.571   0.000   0.005   0.326   0.056   0.042   7.103   0.198   0.105
   13      0.779   7.641  30.647   0.393   4.183   0.003   0.192   0.895   0.032   0.278   0.165   0.092
   14      0.943   1.246  18.708   0.600   0.135   0.002   0.112   0.002  18.892   0.152   0.127   0.092
   15      3.549   1.685  15.883   0.237   0.096   0.001   3.163   0.001   1.111   0.091   0.259   0.434

   16      1.719   1.282  16.021   0.172  47.043   0.000   0.405   0.001   0.338   0.057   0.355   0.402
   17     45.939   0.243   2.534   0.214  16.857   0.000   0.228   0.000   0.201   0.039   0.123   0.292
   18     15.988   0.149   1.348   0.110   1.392   0.000   0.134   0.000   0.130  13.534   0.070   1.043
   19      1.137   0.396   1.202   0.073   0.915   0.000   0.080   0.066   0.092   0.480   0.044   0.105
   20      1.744   1.117   1.080   1.181  11.237   0.000   0.220   0.000   0.071   0.186   0.028   0.077

   21      1.462   1.207   0.397   0.328   1.018   0.000   0.033   0.000   0.148   0.110   0.017   2.132
   22      0.780  92.837   4.540   0.118   0.664   0.000   0.066   0.000   0.079   0.069   3.160   0.456
   23      0.745   2.345   0.913   0.079   0.436   0.033   0.009   0.000   0.053   0.046   0.127   0.140
   24      7.431   1.602   0.531   0.051   0.290   0.010   0.003   0.000   0.043   0.033   0.166   0.072
   25     10.884   1.182   0.442   0.034   0.197   0.007   0.001   0.000   0.036   0.025   0.178   0.044

   26      2.007   1.007   0.324   0.024   0.137   0.011   0.000   0.000   0.032   0.019   0.039   0.028
   27      9.291   1.342   0.260   0.017   0.097   0.011   0.000   0.004   0.028   0.012  16.644   0.019
   28      3.616   1.224   0.213   0.012   0.069   0.006   0.000 665.687   0.025   0.007   0.928   0.013
   29      2.113           0.160   0.009 [illegible] 0.004   0.000   8.571   0.022   0.005   0.383  33.425
   30      1.732           0.693   0.004 [illegible] 0.003   0.795   1.335   0.021   0.003   0.225   3.162
   31      1.898           0.173           0.019           0.020   0.812           0.002           0.220
0 SUM    121.959 205.078 181.657  20.329  84.945   0.833  45.829 677.524  31.726  36.145 100.243  52.489

SUM  of monthly values  1.55876E+03
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                      Existing Tot.Phos.Loss(kg/d)

            Annual data display: Summary for period ending 1989/12

Day         JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1     0.079     1.133     0.000     0.392     0.022     0.169     0.000     0.000     0.000     0.000     0.000     0.062
    2     0.058     0.217     0.000     0.349     0.023     3.527     0.000     0.000     0.000     0.000     0.000     0.063
    3     0.037     0.127     0.000     6.185     0.017     0.468     0.000     0.000     0.000     0.000     0.000     0.041
    4     0.025     0.096     1.316     4.888     0.012     0.368     0.000     0.000     0.000     0.000     0.000     0.026
    5     0.017     0.045     1.977     2.419     0.030     0.069     0.000     0.000     0.000     0.000     0.000     0.026

    6     0.012     0.031     0.060     1.816     0.028     0.075     0.000     0.000     0.000     0.000     0.001     0.014
    7     0.024     0.020     0.011     0.767     0.027     0.043     0.000     0.000     0.000     0.000     0.450     0.011
    8     6.253     0.014     0.008     0.422     0.027     0.025     0.000     0.000     0.000     0.000     0.078     0.006
    9     0.257     0.004     0.057     0.358     0.018     0.012     0.000     0.000     0.000     0.000     0.439     0.006
   10     0.096     0.007     0.193     0.346     0.005     0.011     0.000     0.000     0.000     0.000     0.045     0.011

   11     0.038     0.008     0.263     0.337     0.005     0.006     0.000     0.000     0.000     0.000     0.016     0.005
   12     0.831     0.003     0.108     0.697     0.111     0.006     0.000     0.000     0.000     0.000     0.008     0.005
   13     0.084     0.002     0.041     1.584     0.117     0.012     0.000     0.000     0.000     0.000     0.005     0.005
   14     0.029     0.207     0.084     0.536     0.061     0.006     0.000     0.000     0.000     0.000     0.005     0.005
   15     0.020     0.060     0.392     4.376     0.040     0.004     0.000     0.000     0.000     0.000     3.674     0.000

   16     0.014     0.017     0.087     0.883     0.023     0.004     0.000     0.000     0.000     0.000    14.087     0.000
   17     0.012     0.008     0.068     3.156     0.013     0.010     0.000     0.000     0.000     0.000     0.792     0.000
   18     0.142     0.008    12.507     2.552     0.007     0.019     0.000     0.000     0.000     0.000     0.174     0.000
   19     0.081     0.004     0.988     0.699     0.004     0.667     0.000     0.000     0.000     0.000     0.078     0.000
   20     0.018     0.001     0.457     0.387     0.016     0.527     0.000     0.000     0.000     0.000     0.279     0.000

   21     0.019     0.604     0.247     0.265     0.014     0.101     0.000     0.000     0.000     0.013     0.146     0.000
   22     0.020     0.091     0.215     0.181     0.004     2.462     0.000     0.000     0.000     0.008     0.072     0.000
   23     0.125     0.008     0.665     0.121     0.013     0.103     0.000     0.000     0.000     0.001     0.038     0.000
   24     0.161     0.001     0.865     0.091     0.031     0.092     0.000     0.000     0.000     0.000     0.021     0.000
   25     0.075     0.000     1.941     0.071     0.128     0.036     2.190     0.000     0.000     0.000     0.028     0.000

   26     3.915     0.000     1.601     0.075     8.877     0.017     0.011     0.000     0.000     0.000     0.101     0.000
   27     0.176     0.000     1.729     0.069     0.107     0.012     0.000     0.000     0.000     0.000     0.070     0.000
   28     0.107     0.000     3.929     0.054     0.075     0.007     0.000     0.000     0.000     0.000     2.229     0.000
   29     0.895               2.921     0.043     0.042     0.002     0.000     0.000     0.000     0.000     0.092     0.000
   30     1.733               1.140     0.035     0.560     0.000     0.000     0.000     0.000     0.000     0.097     0.000
   31     0.664               0.624               0.168               0.000     0.000               0.000               0.016
0 SUM    16.017     2.716    34.494    34.154    10.625     8.860     2.201     0.000     0.000     0.022    23.025     0.302

 SUM  of monthly values  1.32416E+02


                      Existing Tot.Phos.Loss(kg/d)

            Annual data display: Summary for period ending 1990/12

Day         JAN       FEB       MAR       APR       MAY       JUN       JUL       AUG       SEP       OCT       NOV       DEC

    1     0.034     0.194     0.118     0.975     0.041     0.022     0.220     0.046     0.209     0.213     0.062     0.153
    2     0.086     2.553     0.330     7.548     0.031     0.005     0.104     0.020     0.104     0.160     0.056     0.137
    3     0.154     1.189     1.894     3.406     0.026     0.179     0.053     0.009     0.054     0.121     0.054     5.436
    4     1.616     0.645     0.306     1.486     0.056     0.124     0.024     0.006     0.044     7.843     0.051    26.450
    5     2.291     0.408     0.173     0.703     0.091     0.060     0.010     0.022     0.028     0.334    44.539     1.657

    6     0.884     0.493     0.118     0.632     0.049     0.020     0.004     0.009     1.565     0.181    23.608     0.799
    7     0.582     1.847     0.086     0.408     0.040     0.000     0.000     0.002     5.359     0.244     1.710     0.687
    8     0.645    51.815     0.071     0.310     0.027     1.616     0.176     0.000     0.781     0.266     1.007     1.217
    9     1.396   150.104     6.589     0.256     0.018     0.422    18.508     0.000     0.316    36.331     1.095     2.507
   10     3.164    11.696    10.320    24.498     0.021     0.194     0.197     0.000     0.207    19.050     2.072     2.251

   11     3.762     2.447    35.487    13.000     0.018     0.107     0.116     0.000     0.130    38.970     0.795     0.610
   12     1.800     1.229    40.426     1.291     0.009     0.072     0.052     0.003     0.079    14.668     0.396     0.493
   13     0.920     2.447    49.550     0.760     1.555     0.047     0.028     0.253     0.058     3.362     0.234     0.744
   14     0.645     0.994    19.717     0.809     0.427     0.034     2.780     0.052    20.611     0.591     0.170     0.263
   15     0.552     0.582     8.007     1.013     0.284     0.019     0.440     0.019    12.502     0.309     0.148     0.166

   16     0.711     0.493     9.787     0.613    13.745     0.009     0.210     0.007     2.261     0.236     0.167     1.010
   17    45.289     0.436     5.417     0.863    33.565     0.005     0.136     0.005     0.828     0.294     0.156     0.308
   18   151.801     0.382     1.942     0.526     7.019     0.012     0.074     0.002     0.402    44.803     0.131     9.829
   19     8.753     0.306     1.942     0.373     2.067     0.003     0.042     0.011     0.429     1.383     0.133     3.268
   20     2.553     0.086     1.439     1.156     8.076     0.000     0.129     0.013     0.353     0.529     0.129     0.411

   21     0.920     0.282     1.396     5.209     4.991     0.000     0.054     0.005     0.276     0.457     0.102     4.440
   22     0.744   387.328     3.107     0.871     1.492     0.000     0.045     0.005     0.464     0.565     5.077     7.083
   23     0.645    74.389     6.972     0.476     0.671     5.918     0.051     0.004     0.273     0.463     0.752     5.436
   24     6.665    10.230     0.496     0.329     0.330     1.165     0.032     0.000     0.556     0.365     0.312     0.529
   25    20.753     0.678     0.363     0.239     0.220     0.335     0.018     0.000     0.289     0.307     0.278     0.141

   26     9.787     0.408     0.306     0.180     0.179     0.216     0.010     0.000     0.251     0.253     0.198     0.093
   27     2.769     0.259     0.238     0.116     0.124     0.187     0.005     0.155     0.194     0.217     2.962     0.082
   28     3.949     0.173     0.220     0.084     0.090     0.108     0.003   225.173     0.140     0.193     4.530     0.082
   29     1.071               0.207     0.054     0.106     0.078     0.000    15.602     0.119     0.166     0.654   160.237
   30     0.522               0.903     0.040     0.060     0.809     0.668     1.995     0.194     0.159     0.202    46.525
   31     0.259               0.779               0.046               0.062     0.397               0.141               3.090
0 SUM   275.722   704.093   208.706    68.224    75.474    11.766    24.251   243.815    49.076   173.174    91.780   286.134

 SUM  of monthly values  2.21221E+03
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                                      No Till Tot.Phos. Loss(kg/d)

                           Annual data display: Summary for period ending 1989/12

    Day         JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

      1       0.003   1.116   0.004   0.616   0.018   0.268   0.017   0.028   0.021   0.015   0.011   0.064
      2       0.004   0.136   0.003   0.427   0.015   8.583   0.014   0.028   0.020   0.015   0.011   0.047
      3       0.002   0.078   0.003   2.073   0.012   4.445   0.012   0.027   0.020   0.015   0.011   0.047
      4       0.002   0.044   1.084   1.668   0.010   0.763   0.012   0.027   0.020   0.015   0.011   0.045
      5       0.001   0.033   0.085   1.507   0.024   0.467   0.011   0.027   0.020   0.015   0.011   0.050

      6       0.001   0.030   0.060   0.922   0.025   0.303   0.011   0.027   0.020   0.014   0.031   0.054
      7       0.341   0.010   0.031   0.621   0.023   0.201   0.010   0.026   0.019   0.014   0.418   0.039
      8       3.218   0.005   0.029   0.417   0.034   0.135   0.010   0.026   0.019   0.014   0.115   0.027
      9       0.106   0.003   0.020   0.280   0.030   0.093   0.010   0.026   0.019   0.014   0.538   0.019
     10       0.062   0.003   0.014   0.191   0.024   0.065   0.010   0.026   0.019   0.018   0.098   0.015

     11       0.036   0.020   0.020   0.130   0.019   0.045   0.010   0.025   0.019   0.022   0.082   0.012
     12       0.441   0.004   0.019   0.881   0.055   0.039   0.010   0.025   0.018   0.019   0.068   0.011
     13       0.050   0.119   0.019   0.411   0.047   0.043   0.010   0.025   0.018   0.017   0.053   0.010
     14       0.031   0.141   0.021   0.308   0.037   0.038   0.009   0.025   0.018   0.016   0.056   0.010
     15       0.019   0.035   0.030   7.202   0.029   0.032   0.009   0.024   0.018   0.015   4.697   0.010

     16       0.012   0.010   0.025   0.808   0.022   0.029   0.009   0.024   0.018   0.014   2.541   0.010
     17       0.008   0.006   0.018   3.820   0.016   0.042   0.009   0.024   0.018   0.015   1.004   0.010
     18       0.017   0.004   5.561   1.082   0.012   0.073   0.009   0.024   0.017   0.016   0.599   0.010
     19       0.013   0.003   0.218   0.669   0.009   2.988   0.009   0.023   0.017   0.015   0.366   0.010
     20       0.011   0.011   0.175   0.446   0.024   0.523   0.009   0.023   0.017   0.017   0.228   0.010

     21       0.007   0.128   0.138   0.303   0.012   0.325   0.009   0.023   0.017   0.024   0.146   0.010
     22       0.005   0.021   0.103   0.210   0.009   0.335   0.009   0.023   0.017   0.022   0.095   0.010
     23       0.042   0.012   0.147   0.147   0.019   0.247   0.009   0.022   0.017   0.018   0.065   0.010
     24       0.020   0.007   0.296   0.104   0.019   0.180   0.009   0.022   0.016   0.016   0.046   0.010
     25       0.015   0.006   0.712   0.073   0.061   0.127  13.607   0.022   0.016   0.014   0.034   0.010

     26       2.046   0.003   1.122   0.060  47.669   0.089   0.275   0.022   0.016   0.013   0.028   0.010
     27       0.097   0.003   2.086   0.049   1.591   0.067   0.139   0.022   0.016   0.013   0.694   0.010
     28       0.936   0.008   2.796   0.037   0.959   0.049   0.076   0.021   0.016   0.012   1.102   0.010
     29       0.346           2.266   0.029   0.585   0.035   0.042   0.021   0.016   0.012   0.158   0.010
     30       0.250           1.366   0.023   0.388   0.024   0.029   0.021   0.015   0.012   0.098   0.011
     31       2.013           0.901           0.288           0.028   0.021           0.011           5.117
0 SUM        10.154   2.002  19.374  25.515  52.088  20.653  14.442   0.749   0.536   0.484  13.416   5.729

  SUM  of monthly values  1.65141E+02
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                                      No Till Tot.Phos. Loss(kg/d)

                           Annual data display: Summary for period ending 1990/12

    Day         JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

      1       0.362   7.186   0.569   1.736   0.040   0.073   0.096   0.261   0.133   0.142   0.069   0.232
      2       0.345   1.937   8.454   2.323   0.031   0.057   0.076   0.150   0.077   0.135   0.065   0.181
      3       0.411   0.559   1.050   1.006   0.023   0.107   0.059   0.088   0.052   0.128   0.062  14.551
      4       2.249   0.571   0.742   0.735   0.039   0.127   0.047   0.053   0.037   0.670   0.058   1.163
      5       0.474   0.572   0.618   0.539   0.116   0.109   0.037   0.043   0.029   0.151  91.340   0.556

      6       0.475  51.490   0.555   0.396   0.102   0.089   0.029   0.028   8.715   0.130   2.876   0.364
      7       0.577   4.287   0.462   0.295   0.082   0.072   0.023   0.020  11.782   0.116   0.807   0.255
      8       0.497  15.180   0.455   0.223   0.066  12.250   0.018   0.017   0.480   0.106   0.510   0.260
      9       0.584  48.658   0.613   0.168   0.052   0.556  69.788   0.016   0.316  12.727   0.925   0.392
     10       0.258   1.780  21.024  11.695   0.042   0.405   1.131   0.015   0.224   3.280   0.552   0.448

     11       0.141   1.245  30.692   2.499   0.034   0.297   0.674   0.014   0.172  14.458   0.385   0.479
     12       0.101   0.947  52.440   1.853   0.026   0.219   0.408   0.091   0.141  12.755   0.320   0.540
     13       0.262  11.592  60.127   1.347  19.208   0.162   0.252   5.106   0.122   0.865   0.301   0.548
     14       0.321   1.109  29.126   1.144   1.310   0.121   0.159   0.305  31.917   0.403   0.340   0.482
     15       4.563   0.872  22.016   0.959   0.912   0.091  19.922   0.186   1.697   0.272   1.171   0.896

     16       0.687   0.698  22.351   0.712  48.003   0.069   1.228   0.117   0.692   0.201   0.975   0.965
     17      90.655   0.377   3.038   0.716  15.202   0.052   0.735   0.076   0.450   0.159   0.521   0.582
     18      32.648   0.225   1.610   0.568   2.173   0.046   0.446   0.051   0.333  22.896   0.300   1.480
     19       1.190   0.180   1.235   0.424   1.524   0.041   0.274   0.040   0.301   0.716   0.191   0.519
     20       1.012   0.332   0.978   1.864   7.855   0.033   0.182   0.033   0.240   0.430   0.129   0.383

     21       0.861   0.409   0.759   0.852   1.591   0.027   0.120   0.025   0.222   0.283   0.093   4.056
     22       0.539 165.111   4.316   0.612   1.129   0.025   0.089   0.020   0.218   0.202   5.733   1.785
     23       0.400   4.546   2.037   0.451   0.801   0.469   0.064   0.018   0.195   0.158   0.360   0.682
     24       7.303   1.247   1.444   0.330   0.570   0.277   0.046   0.016   0.185   0.132   0.250   0.409
     25      17.700   0.937   1.115   0.243   0.408   0.247   0.035   0.015   0.170   0.115   0.571   0.261

     26       1.429   0.675   0.878   0.177   0.295   0.211   0.026   0.014   0.159   0.106   0.156   0.179
     27      15.258   0.641   0.712   0.129   0.215   0.223   0.021   0.025   0.150   0.097  15.379   0.133
     28       3.835   0.627   0.589   0.096   0.158   0.187   0.019 129.695   0.141   0.089   1.866   0.107
     29       1.222           0.454   0.071   0.134   0.152   0.018   2.221   0.133   0.087   0.568  62.387
     30       0.863           0.530   0.053   0.118   0.121   5.323   0.412   0.156   0.079   0.347   6.199
     31       0.725           0.473           0.093           0.469   0.276           0.072           0.724
0 SUM       187.944 323.990 271.462  34.217 102.352  16.916 101.815 139.444  59.639  72.161 127.221 102.197

  SUM  of monthly values  1.53936E+03
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                                          Fallow K.CK.Test TP  (kg/d)

                              Annual data display: Summary for period ending 1989/12

  Day          JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1        0.000   0.706   0.003   0.603   0.024   0.103   0.013   0.017   0.013   0.009   0.007   0.061
    2        0.000   0.065   0.003   0.512   0.020   9.132   0.012   0.017   0.012   0.009   0.007   0.046
    3        0.000   0.039   0.003   4.034   0.016   6.213   0.012   0.016   0.012   0.009   0.007   0.040
    4        0.000   0.023   1.720   1.663   0.013   0.562   0.012   0.016   0.012   0.009   0.007   0.036
    5        0.000   0.018   0.079   1.323   0.024   0.327   0.011   0.016   0.012   0.009   0.007   0.034

    6        0.000   0.014   0.074   0.875   0.028   0.210   0.011   0.016   0.012   0.009   0.020   0.033
    7        0.003   0.008   0.036   0.601   0.027   0.138   0.011   0.016   0.012   0.009   0.041   0.026
    8        0.141   0.003   0.057   0.412   0.036   0.093   0.011   0.016   0.011   0.009   0.052   0.018
    9        0.003   0.003   0.030   0.283   0.034   0.064   0.011   0.015   0.011   0.008   0.060   0.014
   10        0.002   0.003   0.020   0.198   0.028   0.044   0.011   0.015   0.011   0.011   0.039   0.012

   11        0.002   0.012   0.028   0.139   0.023   0.031   0.010   0.015   0.011   0.015   0.028   0.011
   12        0.061   0.006   0.028   3.359   0.043   0.029   0.010   0.015   0.011   0.013   0.020   0.011
   13        0.006   0.059   0.029   0.469   0.043   0.033   0.010   0.015   0.011   0.011   0.014   0.010
   14        0.003   0.080   0.031   0.336   0.037   0.029   0.010   0.015   0.011   0.010   0.016   0.010
   15        0.002   0.018   0.044  20.860   0.030   0.025   0.010   0.015   0.011   0.009   1.041   0.009

   16        0.001   0.006   0.041   1.145   0.024   0.024   0.010   0.014   0.011   0.008   2.895   0.009
   17        0.001   0.004   0.069  13.388   0.018   0.031   0.010   0.014   0.010   0.009   0.406   0.009
   18        0.007   0.003  11.525   1.554   0.014   0.055   0.010   0.014   0.010   0.010   0.270   0.009
   19        0.005   0.003   0.308   0.962   0.010   0.135   0.010   0.014   0.010   0.009   0.182   0.009
   20        0.003   0.009   0.250   0.627   0.018   0.174   0.010   0.014   0.010   0.011   0.125   0.008

   21        0.002   0.039   0.171   0.423   0.012   0.137   0.009   0.014   0.010   0.017   0.088   0.008
   22        0.001   0.015   0.140   0.290   0.010   0.192   0.009   0.014   0.010   0.016   0.064   0.008
   23        0.025   0.009   0.176   0.203   0.021   0.134   0.009   0.013   0.010   0.013   0.047   0.008
   24        0.009   0.005   0.317   0.145   0.018   0.101   0.009   0.013   0.010   0.011   0.036   0.008
   25        0.004   0.005   0.858   0.104   0.016   0.072   4.717   0.013   0.010   0.009   0.028   0.008

   26        0.317   0.003   1.168   0.079   6.749   0.051   0.036   0.013   0.010   0.008   0.022   0.008
   27        0.002   0.003   2.311   0.061   0.292   0.035   0.018   0.013   0.009   0.008   1.683   0.008
   28        0.227   0.003   2.668   0.048   0.190   0.024   0.017   0.013   0.009   0.008   2.332   0.008
   29        0.067           2.088   0.037   0.126   0.017   0.017   0.013   0.009   0.007   0.141   0.008
   30        0.059           1.272   0.030   0.126   0.014   0.017   0.013   0.009   0.007   0.091   0.008
   31        1.314           0.854           0.082           0.017   0.012           0.007           3.254
0 SUM        2.269   1.162  26.401  54.763   8.154  18.228   5.090   0.449   0.321   0.307   9.773   3.748

 SUM  of monthly values  1.30664E+02
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                                          Fallow K.CK.Test TP  (kg/d)

                              Annual data display: Summary for period ending 1990/12

  Day          JAN     FEB     MAR     APR     MAY     JUN     JUL     AUG     SEP     OCT     NOV     DEC

    1        0.224  12.412   0.535   6.314   0.044   0.080   0.084   0.119   1.349   0.148   0.069   0.415
    2        0.199   2.371  12.976   6.717   0.034   0.061   0.066   0.072   0.779   0.140   0.065   0.297
    3        0.233   0.856   1.195   1.382   0.026   0.114   0.052   0.045   0.471   0.132   0.061  19.303
    4        2.601   0.684   0.839   1.018   0.043   0.150   0.041   0.030   0.301   0.413   0.058   1.561
    5        0.357   0.732   0.675   0.750   0.104   0.140   0.033   0.034   0.206   0.155 172.834   0.801

    6        0.348  72.587   0.584   0.558   0.092   0.121   0.026   0.029   5.516   0.132   5.844   0.501
    7        0.438   7.334   0.508   0.420   0.076   0.100   0.021   0.028  17.842   0.117   1.778   0.332
    8        0.350  21.313   0.496   0.321   0.061   1.540   0.016   0.026   1.214   0.106   1.087   0.299
    9        0.452  67.869   2.901   0.249   0.049   0.209  96.553   0.025   0.734  10.898   1.593   0.395
   10        0.198   2.469  38.675  20.686   0.038   0.172   2.863   0.025   0.473   4.501   1.025   0.443

   11        0.110   1.755  43.376   2.774   0.031   0.139   1.641   0.024   0.330  16.686   0.693   0.472
   12        0.080   1.344  73.554   2.057   0.024   0.110   0.957   0.026   0.249  16.977   0.527   0.509
   13        0.212  17.311  83.008   1.502   8.721   0.086   0.570   0.210   0.201   0.934   0.452   0.489
   14        0.255   1.580  48.798   1.253   0.582   0.068   0.346   0.080  45.596   0.477   0.440   0.450
   15        5.607   1.278  41.780   1.014   0.443   0.053   6.957   0.067   2.783   0.309   1.111   1.214

   16        0.643   1.058  34.541   0.756 120.238   0.041   1.436   0.056   1.071   0.218   0.908   1.062
   17      119.459   0.493   4.163   0.670  43.164   0.032   0.845   0.045   0.668   0.165   0.522   0.790
   18       42.762   0.304   2.036   0.551   4.259   0.025   0.507   0.036   0.467  32.992   0.319   1.533
   19        1.528   0.250   1.522   0.421   2.868   0.020   0.311   0.034   0.399   0.912   0.201   0.462
   20        1.363   0.372   1.180   2.186  28.076   0.017   0.234   0.032   0.301   0.553   0.132   0.342

   21        1.133   0.436   0.911   0.834   3.174   0.016   0.152   0.029   0.292   0.349   0.093   4.318
   22        0.721 234.766  10.220   0.602   2.140   0.017   0.103   0.027   0.294   0.237   6.337   1.549
   23        0.603   4.749   2.632   0.455   1.463   0.088   0.077   0.025   0.248   0.177   0.402   0.596
   24       16.241   1.463   1.765   0.339   1.011   0.205   0.056   0.024   0.217   0.141   0.276   0.358
   25       24.440   1.048   1.385   0.253   0.713   0.195   0.041   0.023   0.195   0.120   0.500   0.231

   26        2.016   0.761   1.104   0.187   0.506   0.170   0.033   0.022   0.179   0.108   0.148   0.157
   27       21.665   0.664   0.904   0.138   0.364   0.186   0.031   0.021   0.165   0.099  39.926   0.116
   28        5.356   0.606   0.757   0.103   0.264   0.159   0.0301676.941   0.154   0.090   2.780   0.091
   29        1.808           0.597   0.077   0.194   0.130   0.029  22.381   0.144   0.086   1.108  77.893
   30        1.231           1.365   0.058   0.144   0.105   1.382   3.739   0.158   0.080   0.658   6.531
   31        0.999           0.645           0.107           0.217   2.304           0.073           0.767
0 SUM      253.633 458.866 415.628  54.646 219.053   4.550 115.7081706.580  82.999  88.524 241.950 124.278

 SUM  of monthly values  3.76642E+03
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